

everyday electronics

FEB. 72

15p

433
**A NEW MAGAZINE
BRINGING A FASCINATING
HOBBY TO EVERYONE**

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THEORY SIMPLY EXPLAINED**

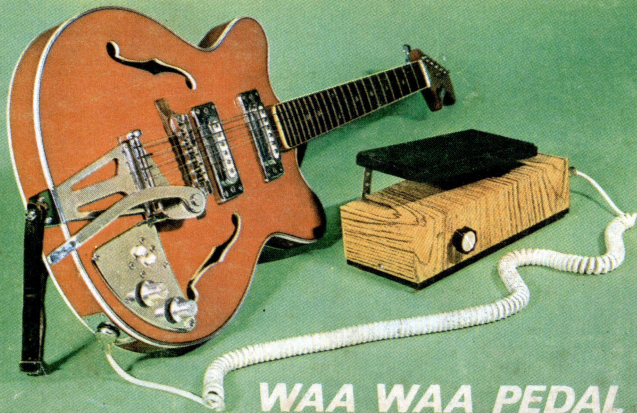
Australia 40c
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STICK DOWN WIRING

AUTO ALERT for Motorway Driving



RAIN WARNING ALARM



WAA WAA PEDAL

ADCOLA Soldering Instruments add to your efficiency

THE NEW 'INVADER'

ADCOLA L.646

for Factory Bench Line Assembly

A precision instrument—supplied with standard 3/16" (4.75 mm) diameter, detachable copper chisel-face bit*.

Standard temp. 360°C at 23 watts.

Special temps. from 250°C—410°C.

*Additional Stock Bits (illustrated) available

COPPER

B 38 $\frac{1}{4}$ " — 3.2 mm CHISEL FACE

B 14 $\frac{1}{8}$ " — 2.4 mm CHISEL FACE

B 24 $\frac{1}{8}$ " — 4.75 mm SCREWDRIVER FACE

B 12 $\frac{1}{8}$ " — 4.75 mm EYELET BIT

B 58 $\frac{1}{2}$ " — 6.34 mm CHISEL FACE

LONG LIFE

B 42 LL $\frac{1}{4}$ " — 4.75 mm CHISEL FACE

B 38 LL $\frac{1}{4}$ " — 3.2 mm CHISEL FACE

B 14 LL $\frac{1}{8}$ " — 2.4 mm CHISEL FACE

B 44 LL $\frac{1}{8}$ " — 4.75 mm SCREWDRIVER FACE

PRICE
£1.85



Don't take chances. We don't. All our ADCOLA Soldering Instruments are of impeccable quality. You can depend on ADCOLA day after day. That's why they're so popular. You get consistent good service... reliability... from our famous thermally controlled ADCOLA Element and the tough steel construction of this ideal production tool.



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*
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price list
and
catalogue

SAFELOC

of robust construction

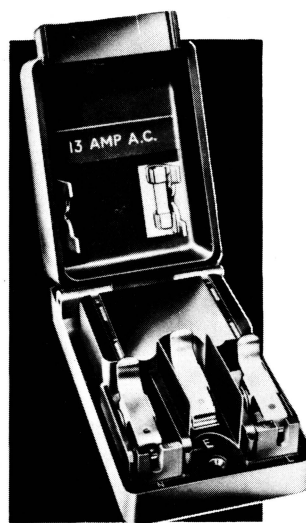
Safe, quick and secure it connects 2-core and 3-core bare-ended flexible leads to the mains (A.C. only).

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Safebloc saves time. No need to fit a plug for tests. No danger, as no current can pass with the lid open.

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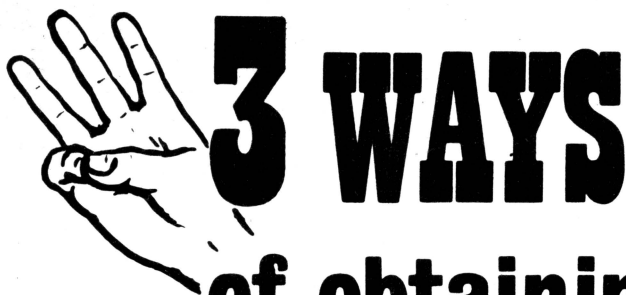
Rendar Instruments Ltd., Victoria Road, Burgess Hill, Sussex. Tel. Burgess Hill 2642

FELSTEAD (EE4) ELECTRONICS

LONGLEY LANE, GATLEY, CHEADLE, CHESHIRE SK8 4EE

Selection from our list, sent free for stamped addressed envelope. (Free overseas). Cash with Order only—No COD or Caller service. Charges (Min. 6p.) in brackets after all items apply to G.B. & Eire only. Regret Orders under 25p. plus charges unacceptable. SAE please, for enquiries or cannot be replied to. Overseas Orders welcomed.

RECORDING TAPE: Finest quality/value British Mylar available: **STANDARD** 5" 600ft 36p; 5 1/2" 900ft 50p; 7" 1200ft 56p; **LONG PLAY** 5" 900ft 50p; 5 1/2" 1200ft 56p; 7" 1800ft 90p. (7 1/2p on 5" and 5 1/2", 9p on 7"). Other sizes, Cassettes and accessories in list. **CARTRIDGES:** All with standard fittings and stylus. Mono GP67 85p; Stereo-compatible Mono GP91/8C £1.10; STEREO GP93 £1.40; Stereo Ceramic GP94 £1.95. (6p) Comparatives shown in list with more types incl. Sonotone 9TAHC Goldring &c. at lowest prices include **DIAMOND** **STYLUS:** Single tip types: Acos GP37, GP59, GP65/67, GP71, BSR TCS/LS/ST, COLLARO O, P and DC284; GARRARD GC2, GC8, GC12, GC810; RONETTE BF40, O, P and T; PHILIPS 3301 (3060, 3066, 3302, 3304) 3010 (12, 13, 16); SONOTONE 19T/20T. ALL AT 40p each (6p). Double-tip turn-over types (78 sap. on other side). For Acos GP73, GP91 (for cartridges GP93, GP94 &c.) GP918C (for stereo-compat. types) GP104, BSR ST4 (ST3, ST5), ST9 (ST8), ST12/14/15, SONOTONE 9TA, 9TA, 9TAHC, PHILIPS 3306 (3310, 3324, 3225/22, GP280) GARRARD GCM21, 22, GCS23, GK825 and 26, GCM21 and 22T, GKM24T, GCS231, GK825T & 26T GCM31, GCS36, GCS35, GCS38, KS40A, KS41B, etc. ALL AT 75p (6p). **DOUBLE DIAMOND STYLUS:** (Same dia. tip each side: no 78) for all types £1.50 (6p). **PICK-UP WIRE:** Super thin twin flex screened, sheathed, 6p per yard. (Up to 6 yds, 6p, over charges paid.) All sapphires in list. **MICROPHONES:** CRYSTAL: LAPEL 1 1/2", clip/hand, lead 3-mm jack plug 32 1/2p (6p). CM20 Cream Plastic hand 52 1/2p; CM21 Grey Plastic Hand/Desk 62 1/2p; both have 3-mm jack plug and lead (9p either). "STICK" 60 £1.02; CM70 "PLANET" Metal, tapered, with neck cord, adaptor for stands £1.47; "MIC 91" hand/desk 81p; "MIC 45" Curved metal hand grip £1.00. All with leads (all 9p). **MICROPHONE INSERTS** Diam. 1.75 or 0.9 either size 27 1/2p (Up to 6 for 6p). **DYNAMIC:** 209 Cardioid Ball, 50K/600 Ω , built-in volume control, on/off switch, special 20ft lead, the best value anywhere £5.80; UD130, uni-dir. mesh ball 50K/600 Ω jack plug, cable, adaptor, £4.80; DM150, omni-dir. ball mesh, 50K, cable, adaptor, jack plug £3.87; (27 1/2p each). **SPEAKERS:** Still very popular 12" ROUND, fitted tweeter, 3 or 15 ohms (State which) £1.87; (27 1/2p) — or pair for stereo £4.25 charges paid. **SMALL 2 1/2"** 3 Ω or 8 Ω , state which 37 1/2p (6p). More speakers in list. **HEADPHONES:** High resistance 2000 Ω adjustable 92 1/2p (7 1/2p). **EARPIECES** with lead and min. 2.5mm or 3.5mm (state which) jack plug, MAGNETIC 9p. CRYSTAL (3.5mm plug only) 24p (up to 3 for 6p, any type). **SOLDERING IRON:** Slim, modern, British high speed, 5 1/2", all parts replaceable, highest quality fully guaranteed £1.17; (10p). **TRANSFORMERS:** Sub-min 11x11x12mm, OUTPUT (3 Ω for OC72, &c.) 14p, or DRIVER 15p (up to 12 for 6p). **CONNECTING WIRE:** Packs of 5 coils, each coil 5 yds., asstd. coils. SOLID CORE 14p. FLEXIBLE or SUPER THIN for transistor wiring &c. either 16p. (Any pack 6p). **RETRACTABLE FLEXIBLE LEADS.** (CURLIES): With phono plug ea. end 6ft 25p, 12ft 30p. With phono/phono socket other end 6ft 25p, 12ft 42 1/2p (6p lead any type). **VIBRATORS:** 12V 4-pin non-synch 121HD4, 2 1/2" ex. pins 27 1/2p. SAME but 3 1/2" ex. pins, USA, 20p. 12V 7-pin, synch. (12SR7) 2 1/2" ex. pins 62 1/2p (6p any type). **TRANSISTORS** &c. AC/126 12 1/2p, AF115 20p, AF116 15p, AF117 20p, OA5 10p, OA10 10p, OA81 10p, OC44 14p, OC45, OC71, OC72, OC75, OC810, OC820, all at 12 1/2p each, OC81 15p, OC170 20p, OC171 12 1/2p, BY100/800piv 14p. Many more incl. power types, thyristors &c., in list. **MAINS TROUBLE SHOOTERS:** 10p. **NEON SCREWDRIVER** (socket tester) 17 1/2p (6p either). **MAINS BATTERY ELIMINATOR:** Input 240V AC, Output 3, 6, 7 1/2 and 9V DC by switch selector, On/off switch, pilot lamp, leads, plug, adaptor to suit most transistor sets and cassette recorders. Suitable for model use: £3.15 (24). **OUR CURRENT LIST** (see heading) includes more details of all above plus cartridge replacement table, many unrepeatable Special Offers, and cable, croc. clips, Volume controls, Din plugs, Co-Ax, standard, miniature, phono plugs, sockets and adaptors. Tape Recording and Record Player accessories, panel and Test meters and equipment, Multimeters, min. motors, test prods, switches—rotary, toggle, slide cabinet, lamp &c.—electrolytics, terminals, Veroboard, valve holders, extending aerials for cars and portable sets, ind. lamps and bulbs, dials, mikes, telephone amplifiers and pick-ups, drive cord, inter-coms, capacitance and resistance testing boxes stereo headphones etc., etc.



3 WAYS

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If you live within easy reach of Mitcham or are in the area at any time do call on us. We are almost opposite Mitcham Baths. We open 9 a.m. every weekday. On Wednesdays we close 1 p.m. and all other days, including Saturdays, 5.30 p.m. On Saturdays we have extra staff to deal with queries. We carry a vast stock of components, and 999 times out of a 1,000 we can immediately lay our hands on the particular item required.

2

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We began our Credit Account Service about 18 months ago and it has proved extremely popular. Little wonder! Our customers find it a very simple and convenient way of purchasing all their radio and electronic needs. We supply pre-paid envelopes and order forms and no matter how many orders you send us you make only one payment per month. There are several other advantages with our Credit Account Service. Please write or phone for details.

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3

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Although we are kept busy selling "over the counter" we supply even more by Mail Order. You can telephone any time of day or night, Sundays included. If you ring out of office hours a recording machine takes your message for us to deal with as soon as we open shop again. Our number is 01-648 8422. If you wish to order by post our address is in the panel at the top of the page. We deal with all orders promptly.



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In its 315 pages are listed over 8,000 components, over 1,500 of them illustrated. Each copy contains 10 Vouchers, each worth 5p when used as instructed. Free Supplements are supplied regularly to keep you up-to-date. The Catalogue costs 50p over the counter, or 70p including postage and packing.

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Dept. EE, 234-240 London Rd., Mitcham, CR4 3HD



DRILL CONTROLLER NEW IWK MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **£1.50** plus 13p post and insurance. Made up model also available. **£2.25** plus 13p post and p.

MAINS OPERATED CONTACTOR

220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2 1/2 x 2 x 2 1/2 in. **£1** each.



NEED A SPECIAL SWITCH

Double Leaf Contact. Very slight pressure closes both contacts. **6p** each. **60p** doz. Plastic push button suitable for operating **5p** each, **45p** doz.



AUTO-ELECTRIC CAR AERIAL

with dashboard control switch—fully extendable to 40in. or fully retractable. Suitable for 12v. positive or negative earth. Supplied complete with fitting instructions and ready wired dashboard switch. **£6** plus 25p post and ins.



TOGGLE SWITCH

3 amp. 250v. with fixing ring **71p** each, **75p** doz.

MICRO SWITCH

5 amp. changeover contacts, **9p** each, **£1** doz. 15 amp. Model **10p** each or **£1.05** doz.



MINIATURE WAFFER SWITCHES

2 pole, 2 way—4 pole, 2 way—2 pole, 4 way—3 pole, 4 way—2 pole, 6 way—1 pole, 12 way. All at **18p** each, **£1.80** dozen, your assortment.



WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. **60p** post free.

BLANKET SWITCH

Double pole with neon light into side so luminous in dark. Ideal for dark room light or for use with waterproof element, new plastic case **30p** each. 3 heat model **40p**.



CAR ELECTRIC PLUG

Fits in place of cigarette lighter. Useful method for making quick connection into the electrical system. **38p** each or 10 for **£3.42**.



TREASURE TRACER

Complete Kit (except wooden batteries) to make the metal detector as the circuit in Practical Wireless August issue. **£2.95** plus 20p post and insurance.



QUICK CUPPA

Mini Immersion Heater. 350w. 200/240v. Boils full cup in about two minutes. Use any socket, lamp holder. Have at bedside for tea, baby's food, etc. **£1.25**, post and insurance **14p**. 12v. car model also available same price. Jug heater **£1.50** plus p. & p. **14p**.



SNAP ACTION SLIDE SWITCH

Rated 5a. 240v. Made by Arco. Type fitted in the handles of electric drills, vacuums, etc. **5p** each, 10 for **45p**.



NUMICATOR TUBES

For digital instruments, counters, timers, clocks, etc. Hi-vac XN. 3 Price **£1.45** each, 10 for **£13**.



12 WAY SUB-MINIATURE MULTI-CORE CABLE

7-0076 copper cores, each core P.V.C. insulated and of different colour. P.V.C. covered overall and approx. 3/16in. thick. Price **20p** per yard.



LIGHT CELL

Almost zero resistance in sunlight increases to 10 K Ohms in dark or dull light, epoxy resin sealed. Size approx. 1in. dia. by 1/4in. thick. Rated at 500 MW, wire ended. **43p** with circuit.

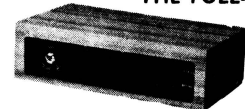
0-8 AMMETER

2in. square full vision for flush mounting. Moving iron instrument. Ideal for charger. Price **43p** each 10 for **£3.90**.



THE FULL-FI STEREO SIX

The amplifier

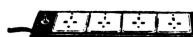


to blend with modern furnishings, this amplifier uses an integrated solid state circuit with an output power of 6 watts R.M.S. split over the two channels. The amplifier is ideal for use with normal pick-ups and tuners, it has a double wound mains transformer and ganged volume and tone controls—also switching from Stereo, tuner or pick-up. Other controls include "treble lift and cut", "balance" and separate mains on/off switch. UNREPEATABLE PRICE is **£9** plus 38p post and insurance.

DISTRIBUTION PANELS

Just what you need for work bench or lab.

4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 7 feet of heavy cable. Wired up ready to work. **£2** less plug **£2.25** with fitted 13 amp plug; **£2.40** with fitted 15 amp plug, plus **23p** P. & I.



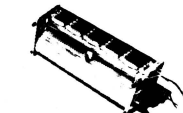
THIS MONTHS SNIP



Smiths 24 hour 20n/20f time switch this is the popular model, as used in the Autotest and Morphy Richards time switches. Only needs a case and an output socket. 230v 50 cycles. Contacts switch up to 13 amps. Price **£2.75p**.

TANGENTIAL HEATER UNITS

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing **£15** and more. We have a few only. Comprises motor, impeller, 2kW element and 1kW element allowing switching 1, 2 and 3kW and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only need control switch. **£3.50**. 2kW Model as above except 2 kilowatts **£2.50**. Don't miss this. Control Switch **85p**. P. & P. **40p**.



POCKET CIRCUIT TESTER

Test continuity of any low resistance circuit, house wiring, car electronics. Tests polarity of diodes and rectifiers. Also ideal size for conversion to signal injector (circuit supplied). **30p** or 2 for **50p** post paid.



COMPUTER TAPE

2,400ft of the Best Magnetic Tape money can buy—users claim good results with Video and sound. In. wide **£1.00** plus 33p post and insurance, with cassette. 1/2 in. wide **£1.00** plus 30p post and insurance with cassette. In. wide **75p** plus 25p post and insurance with cassette. Spare spools and cassettes—1in **75p**, 1/2 in. **75p** each plus 20p post and insurance.



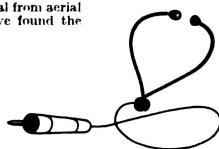
1 HOUR MINUTE TIMER

Made by famous Smiths company, these have a large clear dial, size 4 1/2 x 3 1/2, which can be set in minutes up to 1 hour. After preset period the bell rings. Ideal for processing, a memory jogger or, by adding simple lever, would operate micro-switch **£1.15**.



RADIO STETHOSCOPE

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything—complete kit comprises two special transistors and all parts including probe tube and crystal earpiece. **£2**—1in stetho set instead of earpiece **75p** extra post and ins. **20p**.



70 THINGS YOU CAN MAKE

Send S.A.E. today for list of 70 constructor projects—instruments—alarms—counters—locks—radios, etc., etc.



SOLDER GUN

A must for every busy man, gives almost instant heat also illuminates job. Dual heat 100/140 watt **£3.75** plus post and insurance **20p**. BIG JOE 250 watt model **£4.75** plus post and ins. **40p**.

CAPACITOR DISCHARGE CAR IGNITION

This system which has proved to be amazingly efficient and reliable was first described in the *Wireless World* about a year ago. We can supply kit of parts for an improved and even more efficient version (*Practical* April 1972). When ordering please state whether for positive or negative systems. Also available, ready made ignition systems for 6v. vehicles. **£5.25** plus 20p.



ELECTRONIC IGNITION

Wireless, June). Price **£4.95** plus 20p post. When ordering please state whether for positive or negative systems. Also available, ready made ignition systems for 6v. vehicles. **£5.25** plus 20p.

TYPE 25 RELAYS

These are miniature relays. Size approx. 1 1/4 x 1 1/4 x 1 1/4 in. deep. 4 change over silver/gold contacts. Contact rating lamp 100v D.C. Fitted with a plastic cover. Coil operates approx. 250 Mw D.C. available with the following coils:

28 ohm for 4v—7.5v	45 ohm for 1v—2.5v	52 ohm for 4.5v—6v
90 ohm for 5.5v—11.5v	130 ohm for 10v—15v	530 ohm for 17v—36v
1250 ohm for 27v—44v	2500 ohm for 31v—55v	5800 ohm for 27v—44v

75p each. 10 for **£6.75p**. Also one with 16,500 ohm coil but this has only 2 heavy duty change over gold contacts. Price **£1.45**.



Where postage is not stated then orders over **£5** are post free. Below **£5** add **20p**. Semiconductor add **5p** post. Over **£1** post free. S.A.E. with enquiries please.

DRIVER ALERT WAA-WAA PEDAL RAIN SENSOR and other features

To receive these kits promptly send approximate quoted price and we will refund any change.

Veroboard. We are now stocking this in various sizes. Prices as follows:

2 1/2 x 3 1/2	25p	16p
2 1/2 x 5	24p	24p
3 1/2 x 5 1/2	24p	14p
3 1/2 x 5	27p	27p
17 x 2 1/2	75p	57p
17 x 3 1/2	100p	75p
17 x 5 (plain)	—	75p
17 x 3 1/2 (plain)	—	87p
17 x 2 1/2 (plain)	—	87p
2 1/2 x 5 (plain)	—	17p
2 1/2 x 3 1/2 (plain)	—	15p
Pin intersection tool	47p	47p
Spot face cutter	37p	37p
Pkt. 50 pins	20p	20p

FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke, 2 tube ends, starter, holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A—15-20 w. **£1**. Kit B—30-40 w. **£1**. Kit C—80 w. **£1.20**. Kit E—65 w. **£1.20**. Kit F for 8ft. 125 w. tube **£1.75**. Kit MF1 is for 6in., 9in. and 12in. miniature tubes **£1**. Kit MF2 for 21in. 13 w. miniature tube **£1**. Postage on Kits A and B **23p** for one or two kits then **23p** for each two kits ordered. Kits C, D and E **23p** on first kit then **18p** for each kit ordered. Kit F **33p** then **23p** for each kit ordered. Kit MF1 **18p** on first kit then **15p** on each two kits ordered.

Box Sign for Window Display, at home, office or shop. 24in. wide x 14in. high x 5in. deep. This is an illuminated box sign made from sheet metal hammer finish enamel with a clear plastic window. You simply have your message printed or written on poster board or thick card. (Or use stick down letters available at most stationers). You will then have a box sign normally costing anything between **£10**—**£15**. Illumination is by a 2ft. fluorescent tube with control gear enclosed. Message card can be changed quite easily from hinged top back. Price **£3** each, plus **65p** post, etc. Motivated Illuminated Box Sign. As previous item but with geared motor moving the message making it change eight times a minute. Very attention arresting. To use this for your own messages you would have to have each sign written on card then cut it up in strips which could be glued to the one supplied with the box sign. Price **£4.50**, plus **65p** post and service.

Geared Motor with take off socket. The gear train is driven by normal type induction motor and gives a final speed of 6 r.p.m. The motor is mounted behind a chrome plate through which the take off drive protrudes and was originally intended to drive a spit for cooking, is also ideal for driving models or for driving a colour changing disc for the local dance hall, discotheque, etc. Really well made assembly. Price **£1.75** plus 25p post etc.

2kW FAN HEATER

Three position switching to suit changes in the weather. Switch up for full heater (2kW), switch central blows cold for summer cooling—adjustable thermostat acts as auto control and safety cut-out. Complete kit **£3.95**. Post and ins. **38p**.



KITS FOR PREVIOUS PROJECTS

Kits of parts available as follows—

HOME SENTINEL INTRUDER ALARM

Electronic Components with case **£3.75**

SNAP INDICATOR

All components but not case or battery **75p**.

WINDSCREEN WIPER CONTROL

All components including metal for chassis **£2.00**.

RECORD PLAYER

All components, but not case, loudspeaker, record deck or pick-up **£5.50**.

DEMO DECK

All Components as listed **£6.75**

ASTRON RADIO

Electronics parts less case **£3**

REMOTE TEMPERATURE COMPARATOR

All electronic parts less case **£4.95**

ELECTRO LAUGH

Parts, less case **£2**

TRANSISTOR MICROPHONE

all parts **£1.70**

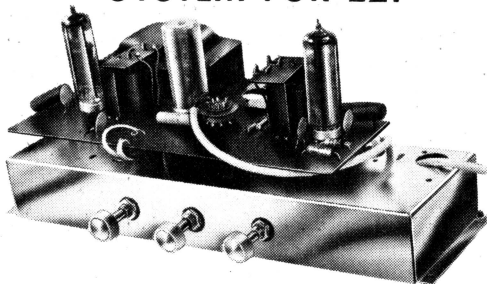
J. BULL (ELECTRICAL) LTD.

(Dept. E.E.) 7 Park Street, Croydon CRO 1YD

Callers to: 102/3 Tamworth Road, CROYDON

Everyday Electronics, February 1972

STEREO AMPLIFIER SYSTEM FOR £21



Stereo amplifier with double wound mains transformer (200-250v. a.c.); 2 x ECL82 valves giving 2 x 2½W; printed circuit (10" x 3½") mounted on metal chassis. Ganged tone controls, sep. vol. controls; on-off switch; excellent channel separation. Output trans. for 3-ohm speakers. For crystal, ceramic cartridges or radio tuner. Only £6.25 (post 40p).

Beautifully finished teak or walnut wooden cabinets 10½" x 5½" x 7" deep, fitted 6" x 4" speakers, 3-ohm. £8 per pair (post 35p). Cabinets only £6 pair (post 25p).

PACKAGE DEAL. B.S.R. autochanger C129 fitted stereo cart., two speakers in cabs. (above), amplifier (above). All for £21 (carr. £1.50) All necessary audio plugs and leads supplied

GLADSTONE RADIO

66 Elms Road, Aldershot, Hants.

Telephone: 22240.

Hi-Fi KITS



FROM
£14.75

- * INDUCTION OR SYNCHRONOUS MOTOR
 - * FULL SIZE TURNTABLE WHEEL
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 - * RIGID BASE
- ILLUSTRATED
THE V-300
THREE SPEED MODEL

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RB101 SINGLE SPEED BELT DRIVEN

P105 PICKUP ARM

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NAME

ADDRESS

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TIME IT WILL STILL
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LOOK OUT OF DATE
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(VEF) 17**
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**28 TRANSISTORS
AND DIODES!**
WAVEBANDS:
STANDARD LONG and MEDIUM
Plus 5 SHORT WAVEBANDS
Plus ULTRA SHORT WAVES
(V.H.F. AM, FM, MW, LW, USW.)

£19.75 BOX POST ETC. 50p
BATTERY MODEL
**MAINS/BATTERY
ELIMINATOR £1.35 extra**

**WE COULDN'T EVEN
MAKE THEM FOR
THIS PRICE!**

**COMPARE
ITS PERFORMANCE
with £75
RADIOS!**

Just think of the year 1984 and the "perfect radio" that might be produced then with all the advanced qualities it could possibly have—now place the fantastic ASTRAD (VEF) 17 in front of you and switch on, and you'll see for yourself that the incredible Russians have done it all HERE AND NOW! It's the radio perfectionist's dream come true! **THIS ONE SUPERSEDES ALL EARLIER MODELS!** Complete with optional battery eliminator for both battery and mains use. We're almost giving them away at only £19.75—a fraction of today's Russian miracle price! We challenge you to compare performance and value with that of £75 radios. * You can't lose, refund if not astounded! Purer and sweeter tone than ever! Much wider band spread than hitherto, for absolute "pin-point" station selection. Plus "MAGIC EYE" tuning level indicator for ultra perfect tuning sensitivity! The Russians have really surpassed themselves this time, proving once again their fantastic ability in the field of electronics and brilliantly reflecting their advanced micro-circuitry techniques in the field of space communications. **YES, EVERY WAVEBAND** instantly at your fingertips, including Standard Long, Medium Short and Ultra Short Waves to cover the four corners of the earth 24 hours a day, including all normal transmissions VHF, AM, FM, MW, LW, USW, plus local & new stations not yet operational, and messages from all over the world. Unique side control waveband selection unit gives incredible ease of station tuning! Superb, sweet tone—controlled from a whisper to a roar that will fill a hall. Genuine push-pull output ON/OFF volume and separate Treble and Bass tone controls for perfection of reproduction and tone! **Press-button dial illumination!** Runs economically on standard batteries (obtainable everywhere) or direct through battery eliminator from 220/240v AC mains supply. Internal ferrite rod aerial plus built-in "rotatable" telescopic aerial extending to 33in. approx. It's also a fabulous **CAR RADIO.** Elegant Black and Chrome case. **SIZE 12½in. x 9½in. x 4½in.** overall approx. Designed to give years of perfect service (UK service facilities and spares available for years to come if ever necessary!). With **WRITTEN GUARANTEE.** Simple instructions and circuit diagram. **ONLY £19.75** (with mains battery eliminator £1.30 extra. **POST, ETC., 50p.** Standard "longlife" batteries plus extra sensitive earphone for personal listening 25p extra if required. Can also be used through extension amplifier, tape recorder or public address system. (Sorry—we cannot change these new radios for any earlier models already purchased.) Refund if not delighted.

BRAND NEW! SAVE £13.98 NOW! FIRST CLASS MAKER'S DE LUXE MODEL

**Cassette
TAPE RECORDER
and
PLAYER**

**RECOMMENDED
LIST PRICE
£26.97p
OUR PRICE
£12.99
POST ETC.
30p**

WITH
REMOTE CONTROL MICROPHONE

MAKE NO MISTAKE—this is the **EXPENSIVE** model with "PIANO KEYBOARD" CONTROL PANEL and SPECIAL RECORDING LEVEL! **SAVE £13.98!** Due to price we cannot mention famous maker's name—but rest assured you're getting one of the **BEST!** Our latest cassette model—no fiddling with awkward tape and reels. Just "slap in" a cassette and off you go! (takes 30-, 60- and 90-minute standard Philips Cassette tapes obtainable everywhere). Amazing performance ensures perfect tapings and superb reproduction! Remote control microphone. Separate volume control! Rapid Rewind! Beautiful tone from a whisper to a roar! Completely self-contained—record everywhere. Separate jacks for remote control microphone, etc. Size 9" x 4½" x 2½" overall approx. Case design can vary slightly. With carry handle. With **WRITTEN G'TEE** and instructions. Only £12.99, post 30p. **ALSO AVAILABLE:** **SPECIAL BATTERY/MAINS AC/DC MODEL**, ready to plug in. £3.50 extra if required. Refund g'tee. **BONUS** one per customer: Cassette tape, set of Standard batteries and microphone stand all for 51p extra if required.

SHOPERTUNITIES LTD.

Dept. EE/F/4, 164 UXBRIDGE ROAD (facing Shepherds Bush Green), LONDON W12 8AQ. (Thurs. 1. Fri. 7). Also 37/39 HIGH HOLBORN (opposite Chancery Lane) LONDON, W.C.1. (Thursday 7 p.m.). BOTH STORES OPEN.

FIND BURIED TREASURE! Transistorised Treasure Locator



ONLY
£2-37

Eavesdrop on the exciting world of Aircraft Communications

V.H.F. AIRCRAFT BAND ONLY CONVERTOR **£2-37**



Listen in to AIR-
LINES, PRIVATE PLANES,
JETPLANES. Eavesdrop on
exciting cross talk between pilots,
ground approach control, air-
port tower. Hear for yourself
the disciplined voices hiding
tenseness on talk downs. Be
with them when they have to take nerve
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the international distress frequency. Covers
the aircraft frequency band including
**HEATHROW, GATWICK, LUTON, KING-
WAY, PRESTWICK, ETC. ETC. CLEAR AS
A BELL.** This fantastic fully transistorised
instrument can be built by anyone over nine
in under two hours. No soldering necessary.
Fully illustrated simple instructions take you
step-by-step. Uses standard PP3 battery.
All you do is extend rod aerial, place close
to any ordinary medium wave radio (even
tiny portables). **NO CONNECTIONS WHAT-
EVER NEEDED. SEND ONLY £2-37 +**
25p p. & p. for kit including case, nuts,
screws, wire, etc. (parts available
separately).

SHORTWAVE

TRANSISTOR RADIO

only
£2-25



Anyone from 9 years up
can follow the
step-by-step, easy as
ABC fully illustrated in-
structions. No soldering necessary.
75 stations logged on rod aerial in 30 mins.—
Russia, Africa, USA, Switzerland, etc.
Experience thrills of world wide news, sport,
music, etc. Eavesdrop on unusual broad-
casts. Uses PP3 battery. Size only 3" x 4 1/2"
x 1 1/2" **Only £2-25 + 17p p. & p.** Kit includes
cabinet, screws, instructions, etc. (Parts
available separately).

INGENIOUS ELECTRONIC SLEEP INDUCER

ONLY
£2-75



CAN'T SLEEP
AT NIGHTS? **DO YOU
WAKE UP
IN THE NIGHT AND CAN'T GET OFF
TO SLEEP AGAIN? WOULD YOU
LIKE TO BE GENTLY SOOTHED OFF
TO SATISFYING SLEEP EVERY NIGHT?**
Then build this ingenious electronic sleep
inducer. It even stops by itself so you don't
have to worry about it being on all night! The
loudspeaker produces soothing audio-
frequency sounds, continuously repeated—
but as time goes on the sound gradually
becomes less and less—until they eventually
cease altogether, the effect it has on people
is amazingly very similar to hypnosis. A control
is provided for adjusting the length of
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anyone over 12 years of age in about two
hours. No knowledge of electronics or radio
needed. Extremely simple, easy-to-follow,
step-by-step, fully illustrated instructions
included. **No soldering necessary.** Works off
standard batteries, extremely economical.
Size only 3" x 4 1/2" x 1 1/2"—take it anywhere.
Kit includes case, nuts, wire, screws, etc.
SEND £2-75 + 25p p. & p. (parts available
separately).

ELECTRONIC ORGAN

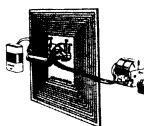


ONLY **£2-75**

Don't confuse
with ordinary
electronic organs that
simply blow air over mouth-organ type reeds etc.
Fully transistorised. **SELF CONTAINED
LOUDSPEAKER.** Fifteen separate keys span
two full octaves—play the "Yellow Rose of
Texas", play "Silent Night", play "Auld Lang
Syne" etc. etc. You have the thrill and
excitement of building it together with the
pleasure of playing a real live, portable
electronic organ. **NO PREVIOUS KNOW-
LEDGE OF ELECTRONICS NEEDED.** No
soldering necessary. Simple as ABC to make.
Anyone over nine years can build it easily in
one short evening following the fully illustrated
step-by-step, simple instructions. **ONLY £2-75**
+ 25p p. & p. for kit, including case, nuts,
screws, simple instructions, etc. Uses
standard battery (parts available separately).
Have all the pleasure of making it yourself,
finish with an exciting gift for someone.

Find buried treasure with this READY BUILT & TESTED TREASURE LOCATOR MODULE

ONLY **£4-95**



FULLY
TRAN-
SISTORISED
CIRCUIT
METAL DETEC-
TOR MODULE. Ready built
and tested—just plug in a PP3 battery and
'phones and it's working. Put it in a case,
screw a handle on and **YOU HAVE A
PORTABLE TREASURE LOCATOR EASILY
WORTH ABOUT £20!** Extremely sensitive
—penetrates through earth, sand, rock,
water, etc.—**EASILY LOCATES COINS,
GOLD, SILVER, JEWELLERY, HISTORI-
CAL RELICS, BURIED PIPES, ETC.**
Signals exact location by "beep" pitch
increasing as you near buried metallic
objects. **So sensitive it will detect certain
objects buried SEVERAL FEET BELOW
GROUND! GIVES CLEAR SIGNAL ON
ONE COIN! £4-95 + 50p carr. etc.**
(High quality Danish Stethoscope head-
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**EXAMINE AT HOME FOR 7 DAYS. YOUR
MONEY REFUNDED IN FULL IF NOT 100%
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Amazing Radio Construc-
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No experience needed.
Parts including
simple instructions
for each design. Illus-
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all transistors, loudspeaker,
personal phone, knobs, screws,
etc. all you need. Presentation box
37p extra as illus. (if required) (parts available
separately) no soldering necessary. Send
£1-97 + 25p p. & p.

SOOTHE YOUR NERVES, RELAX WITH THIS AMAZING RELAXATRON



Only
£2-25

CUTS OUT NOISE POL-
LUTION—SOOTHES YOUR
NERVES! Don't under-
estimate the uses of this fan-
tastic new design—the
RELAXATRON is basically a
pink noise generator. Besides
being able to mask out
extraneous unwanted sounds,
it has other very interesting
properties. For instance,
many people find a rainstorm
mysteriously relaxing, a large
part of this feeling of well-being can be
directly traced to the sound of falling rain-
drops—a well known type of pink noise.
IF YOU WORK IN NOISY OR DIS-
TRACTING SURROUNDINGS, IF YOU
HAVE TROUBLE CONCENTRATING, IF
YOU FEEL TENSED, UNABLE TO RE-
LAX—then build this fantastic Relaxatron.
Once used you will never want to be without
it—**TAKE IT ANYWHERE.** Uses stan-
dard PP3 batteries (current used so small
that battery life is almost shelf-life). **CAN
BE EASILY BUILT BY ANYONE OVER 12
YEARS OF AGE** using our unique, step-by-
step, fully illustrated plans. No soldering
necessary. All parts including case, a pair
of crystal phones. Components, nuts,
screws, wire, etc. no soldering.
£2-25 + 25p p. & p. Parts available separately

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G. F. MILWARD 369 Alum Rock Road, Birmingham B8 3DR. Tel. 021-327 2339

SPECIAL 50p PACKS. ORDER 10 PACKS AND WE WILL INCLUDE AN EXTRA ONE FREE ! ! !

RESISTORS, 1/4 watt		
assorted	100	50p
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No Plug	6	50p
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P.N.P. Untested but mainly O.K.	50	50p
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BY 127 Rectifiers	4	50p
IN4007 Rectifiers (1200V peak)	4	50p
STC 3/4 Rectifiers	6	50p
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Solid Core. Insul. 100yds.	50p	
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CRYSTAL EARPIECES 3.5mm Plug	2	50p
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TRANSISTORISED CAR REV. COUNTER KIT (Needs 1 ma. meter as indicator)	1	50p

STOCKTAKING CLEARANCE! IMPOSSIBLE TO REPEAT!
We have huge numbers of components in quantities too small to advertise individually. In order to "clear the decks" we have made up parcels containing a mixture of carbon and wire-wound resistors, electrolytic and paper condensers, controls, transistors, diodes etc., for a tiny fraction of normal price. It is emphasised that these are mixed parcels only—contents cannot be stipulated! Sold only by weight.

Gross weight 2 lb. £1 (postage 20p)
Gross weight 5 lb. £2 (postage 30p)

G. F. MILWARD, Drayton Bassett, Tamworth, Staffs. Postage (minimum) per order 15p.

Unrepeatable Offer ! ! ! !
Surplus VEROBOARDS, 3 1/4" x 2 1/2" x .15"
Only 10p each or £1.00 per dozen

TANTALUM CAPACITORS. COMPARE THE PRICE—ONLY 10p EACH ! ! ! !

Sub-miniature types	Miniature types				
0.047µF 50 volts	0.022µF 20 volts	5.6 µF 35 volts	10 µF 10 volts		
0.056µF 50 volts	0.033µF 20 volts	8.2 µF 35 volts	8.2 µF 15 volts		
0.07 µF 20 volts	0.047µF 20 volts	15 µF 35 volts	15 µF 15 volts		
0.1 µF 20 volts	0.068µF 35 volts	18 µF 35 volts	18 µF 15 volts		
0.1 µF 50 volts	0.12 µF 35 volts	22 µF 35 volts	22 µF 15 volts		
0.18 µF 20 volts	0.15 µF 35 volts	27 µF 35 volts	27 µF 15 volts		
0.33 µF 35 volts	0.22 µF 50 volts	56 µF 15 volts	56 µF 15 volts		
0.47 µF 35 volts	0.47 µF 50 volts	56 µF 20 volts	56 µF 20 volts		
0.68 µF 20 volts	0.68 µF 35 volts	150 µF 6 volts			
1.0 µF 15 volts	0.68 µF 50 volts				
2.2 µF 3 volts	1.0 µF 35 volts	Standard			
2.7 µF 15 volts	1.0 µF 75 volts	6.8 µF 50 volts			
2.7 µF 35 volts	1.8 µF 20 volts	7.5 µF 20 volts			
3.0 µF 12 volts	2.2 µF 20 volts	8.2 µF 150 volts			
10.0 µF 1.5 volts	2.7 µF 50 volts	12 µF 35 volts			
		12 µF 50 volts			
		15 µF 35 volts			
		20 volts 82 µF 20 volts			
		35 volts 050 µF 15 volts			
		6 volts 270 µF 6 volts			

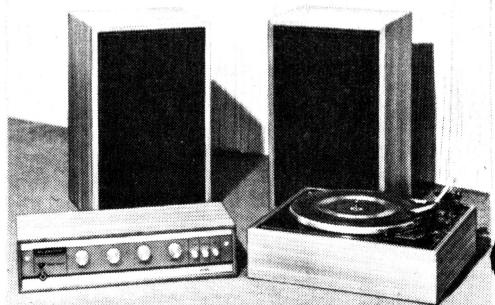
NEW ! NEW ! NEW ! NEW !

An aerosol spray providing a convenient means of producing any number of copies of a printed circuit both simply and quickly.

Method: Spray copper laminate board with light-sensitive spray. Cover with transparent film upon which circuit has been drawn. Expose to light. (No need to use ultra-violet.) Spray with developer, rinse and etch in normal manner.

Light sensitive aerosol spray £1
Developer spray 50p

BUDGET HIGH-FIDELITY STEREO SYSTEMS



PREMIER STEREO SYSTEM "ONE" Consists of the new Premier 800 all transistor stereo amplifier, Garrard 2025 T/C auto manual record player unit fitted stereo mono ceramic cartridge with diamond stylus and mounted in teak finish plinth with perspex cover and two matching teak finish loud-speaker systems. Absolutely complete and supplied ready to plug in and play. 800 amplifier has an output of 5 watts per channel with inputs for ceramic and magnetic pick-up, tape and tuner also tape output socket and headphone socket. Controls: Bass, Treble, Volume, Balance, Selector, Power on/off. Mono/Stereo switch. Stereo Headphone socket. Black leatherette cabinet with aluminium front panel. Size: 12½" x 6½" x 2½". (Amplifier available separately if required £16.25. Carr. 40p).

**ONLY
£57.75**
carr. £1.75

PREMIER STEREO SYSTEM "THREE" This consists of KLINGER KC9003 stereo amplifier giving 6 watts rms per channel with Bass, Treble, Volume and Balance Controls. Inputs for Magnetic and ceramic pick-up, tuner, tape in and out. Stereo earphone socket. Garrard SP25 Mk. III in teak finish plinth with cover and fitted Sonotone 9TAHCD diamond stereo cartridge. A pair of HMF Speakers size 16½" x 10½" x 9" fitted EMI units complete the matching system. **ONLY £57.75.** Carr. £1.75.

**ONLY
£40.95**
carr. £1.75

PREMIER STEREO SYSTEM "TWO", as above but with Garrard SP25 MK III and MAGNETIC cartridge. **ONLY £48.** Carr. £1.75.

FREE

**STEREO
HEADPHONES**

and all leads and plugs supplied with all systems.

PREMIER HI-FI OFFERS

Philips 580 Stereo Amplifier (List £29.00)	£21.00
Rogers Ravensbrook II Stereo Amplifier in teak case (List £52.50)	£39.50
Rogers Ravensbourne Stereo Amplifier in teak case (List £64)	£49.00
Metrosound ST20E Stereo Amplifier in teak case (List £39.50)	£28.50
Golding GL75 less cartridge (List £41.61)	£29.00
Garrard SP25 III with Goldring G800 cartridge (List £28.35)	£15.50
Garrard AP76 less cartridge	£19.50

Garrard 3500 with Sonotone 9TA stereo cartridge (List £15.50) **£9.97**

Garrard 2025 T/C with Sonotone 9TAHC Diamond Cartridge **£9.97**

Garrard 2025 T/C with Sonotone 9TAHC Diamond Cartridge ready wired in teak plinth with cover **£14.00**

Carriage and Insurance 50p extra any item.



TAPE CASSETTES

C60 (60 min.)	37p	3 for £1.05
C90 (90 min.)	62p	3 for £1.80
C120 (120 min.)	87p	3 for £2.55

P. & P. 5p.

FREE CASSETTE HEAD CLEANER with every 10 cassettes purchased.

All cassettes can be supplied with library cases at 3p. extra each

SP25 MKIII SPECIAL!



GARRARD SP25 MK III SINGLE RECORD PLAYER FITTED GOLDRING 800 MAGNETIC STEREO CARTRIDGE as available. COMPLETE IN TEAK PLINTH WITH RIGID PERSPEX COVER. Total list price over £34.

**PREMIER PRICE
£18.90**
P. & P. 50p.



HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2½in speaker units with soft padded ear muffs. Adjustable headband. 8 ohms impedance. Complete with 6ft lead and stereo jack plug.

£2.47 P. & P. 25p.

STEREO STETHOSCOPE SET Low imp. £1.85 P. & P. 10p

MONO STETHOSCOPE SET Low imp. 52p. P. & P. 10p.



E.M.I. 13x8in. HI-FI SPEAKERS

Fitted two 2½in tweeters and crossover network. Impedance 8 or 15 ohm. Handling capacity 10W. Brand new.

£3.47 P. & P. 40p

NEW LOW COST PREMIER 800 STEREO AMPLIFIER



A truly high quality stereo amplifier—compare the specification, compare the price. Output: 5 watts per channel. Frequency response: 30-20,000 Hz ± 2 db. Distortion: 1% Output Impedance 8 ohms nom. Inputs equalised to R.I.A.A. Magnetic 4mV. Ceramic 100mV. Tuner 100mV. Tape 100mV. Tape out 150mV. Din sockets for inputs and outputs. Stereo headphone socket. Attractive slim line design black leatherette cabinet with aluminium front panel. Size 12½" x 6½" x 2½".

ONLY £16.25 Carr. 40p.



WELLER "EXPERT" SOLDER GUN.

Saves time and simplifies soldering in the home and service dept. Two position trigger gives instant dual heat. 100/140 watt. 240 volt A.C. **£4.25** P & P 30p



"Marksman" Soldering Iron. Lightweight & pencil bit. Ideal for regular bench use and around the home. 25 watts. 240 volt A.C. £1.50 P & P 15p

"VERITONE" RECORDING TAPE

SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED. TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped—attractively boxed.

LP3 3" 250' P.V.C.	82p	LP6 6" 1200' P.V.C.	75p
TT3 3" 450' POLYESTER	37p	DT6 6" 1800' POLYESTER	£1.12
DT3 3½" 600' POLYESTER	57p	TT6 6" 2400' POLYESTER	£1.87
SP5 5" 600' P.V.C.	42p	SP7 7" 1200' P.V.C.	62p
LP5 5" 900' P.V.C.	50p	LP7 7" 1800' P.V.C.	75p
DT5 5" 1200' POLYESTER	75p	DT7 7" 2400' POLYESTER	£1.25
DT7 7" 3600' POLYESTER	£2.50		

TAPE SPOOLS 3" 5p, 5", 5½", 7" 9p, Post and Packing 3" 5p, 5", 5½", 7" 10p. (3 reels and over Post Free).



PREMIER RADIO

10 & 23, TOTTENHAM COURT ROAD, LONDON, W.1 TEL: 01-636 3451/2639
HEAD OFFICE & MAIL ORDER DEPT. 23, TOTTENHAM CT. RD. TEL: 01-636 3451



Sinclair Q16/Micromatic

Q16 High fidelity loudspeaker

The Q16 employs the well proven acoustic principles specially developed by Sinclair in which a special driver assembly is meticulously matched to the characteristics of the uniquely designed cabinet. In reviewing this exclusive Sinclair design, technical journals have justly compared the Q16 with much more expensive loudspeakers. Its shape enables the Q16 to be positioned and matched to its environment to much better effect than is the case with conventionally styled enclosures. A solid teak surround with a special all-over cellular foam front is used as much for appearance as its ability to pass all audio frequencies without loss.

This elegantly designed shelf mounting speaker brings genuine high fidelity within reach of every music lover.

Specifications:

Construction: Special sealed seamless sound or pressure chamber with internal baffle.

Loading: up to 14 watts RMS.

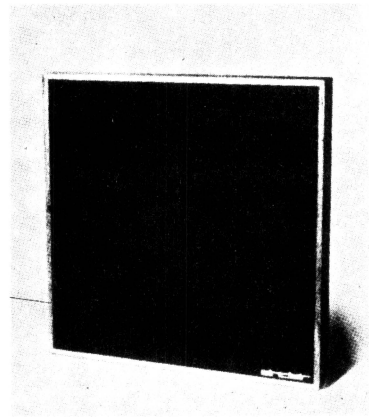
Input Impedance: 8 ohms.

Frequency response: From 60 to 16,000 Hz. confirmed by independently plotted B and K curve.

Driver unit: Special high compliance unit having massive ceramic magnet of 11,000 gauss, aluminium speech coil and special cone suspension for excellent transient response.

Size and styling: 9 $\frac{3}{4}$ in. square on face x 4 $\frac{1}{2}$ in. deep with neat pedestal base. Black all over cellular foam front with natural solid teak surround.

Price £8.98.



Britain's smallest radio

Considerably smaller than an ordinary box of matches, this is a multi-stage AM receiver brilliantly designed to provide remarkable standards of selectivity, power and quality for its size. Powerful AGC counteracts fading from distant stations; bandspread at higher frequencies makes reception of Radio 1 easy. The plug-in magnetic earpiece provided, matches the Micromatic's output to give wonderful standards of reproduction. Everything including the special ferrite rod aerial and batteries is contained within the minute attractively designed case. Whether you build a Micromatic kit or buy this amazing receiver ready built and tested, you will find it as easy to take with you as your wrist watch, and dependable under the severest listening conditions.

Specifications:

Size: 36 x 33 x 13 mm (1.8 x 1.3 x 0.5 in.)

Weight: including batteries, 28.4 gm (1 oz.)

Case: Black plastic with anodised aluminium front panel and spun aluminium dial.

Tuning: medium wave band with bandspread at higher frequencies (550 to 1,600 KHz).

Earpiece: Magnetic type.

On/off switching: By inserting and withdrawing earpiece plug.

Kit in pack with earpiece, case, instructions and solder **£2.48.**

Ready built, tested and guaranteed, with earpiece **£2.98.**

Two Mallory Mercury batteries type RM675 required from radio shops, chemists, etc.



To: SINCLAIR RADIONICS LTD LONDON ROAD ST. IVES HUNTINGDONSHIRE PE17 4HJ

Please send _____

Name _____

Address _____

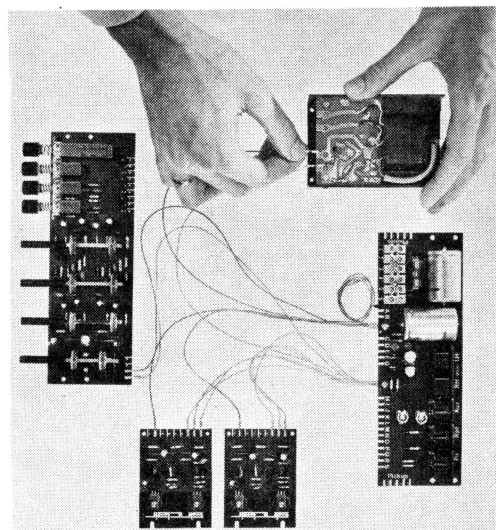
for which I enclose cash/cheque/money order

E.E. 4A

Sinclair Radionics Ltd., London Rd, St. Ives
Huntingdonshire PE17 4HJ.
Telephone St. Ives (048 06) 4311

sinclair

Project 605 the new simple way to assemble Sinclair high fidelity modules



For several years now you have been able to assemble your own high fidelity system to world beating standards using Sinclair modules. We have progressively improved these technically but hitherto the method of assembly at your end has remained the same – there has been no alternative to a soldering iron. Now for those who prefer not to solder, there is an alternative – Project 605.

In one neat package you can now obtain the four basic Project 60 modules plus a fifth completely new one – Masterlink – which contains all the input sockets and output components you previously bought separately. Also in the Project 605 pack are all the inter-connecting leads, cut to length and fitted at each end with plugs which clip straight onto the modules, eliminating soldering completely. The pack contains everything you need to build a complete 30 watt stereo amplifier together with a clear well illustrated Instruction Book. All you have to do is to arrange your modules in the plinth or case of your choice and then clip them together – the work of a few minutes.

Your hi-fi system will, as we said, match the finest in the world and you can add to it at any time to increase power or extend the facilities. For example a superb stereo FM Tuner unit is obtainable for only £25.

Guarantee If within 3 months of purchasing Project 605 directly from us, you are dissatisfied with it, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail, Air-mail charged at cost.

sinclair

Sinclair Radionics Ltd., London Road,
St. Ives, Huntingdonshire PE17 4HJ.
Telephone: St. Ives (04806) 4311

Specifications

Output – 30 watts music power (10 watts per channel R.M.S. into 3 Ω).

Inputs – Mag. P.U. – 3mV correct to R.I.A.A. curve 20–25,000 Hz \pm 1dB. Ceramic pick-up – 50mV. Radio – 50 to 150mV. Aux. adjustable between 3mV. and 3V.

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Project 605 comprises Stereo 60 pre-amp/control unit, two Z-30 power amplifiers, PZ-5 power supply unit, the unique new Masterlink, leads and instructions manual complete in one pack. Post free

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E.E. 4B

BODINE TYPE N.C.I. GEARED MOTOR



(Type 1) 71 r.p.m. inch. Reversible. 1/70th h.p. 0 cycle, 0.38 amp (Type 2) 28 r.p.m. Torque 20lb inch. Reversible. 1/80th h.p., 50 cycle, 0.28 amp. "As new" condition. Input voltage of motor 115V a.c. Supplied complete with transformer for 230/240V a.c. input. Price, either type £3.15 plus 35p P. & P. or less transformer £2.13 plus 27p P. & P.

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Powerful 1 amp. REVERSIBLE motor. Speed 3,750 RPM complete with external gear train (removable) giving final speed of approx. 125 RPM. Size 4 1/2" x 2 1/2" dia. Price 85p incl. post.



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cw=Clockwise. A/cw=Anti-clockwise rotation. Fraction of makers' price. All at 75p incl. P. & P.

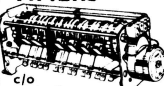
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5 amp c/o contacts. Fitted with removable push button assembly. Ex. P.O. 20 for £1 incl. post. (Min. order 20)



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EXPERIMENTERS' ECONOMY KIT Speed adjustable 1 to 36 Flash per sec. All electronic components including Veroboard S.C.R., Unijunction Xenon Tube and instructions £6.30, plus 25p P. & P.

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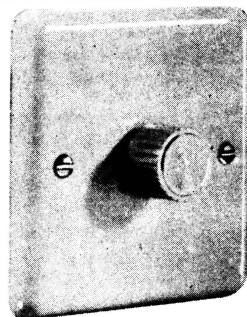
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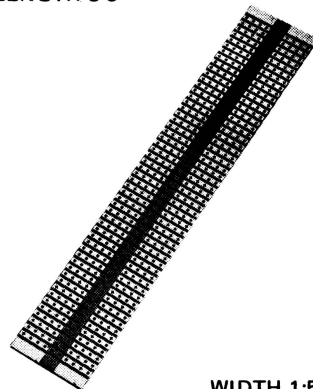
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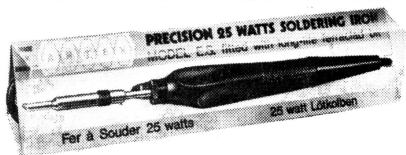
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E.240 20 watt 240 volts soldering iron fitted with 1/4" iron coated bit. Spare bits 3/32", 1/8" and 3/16" available. Can also be supplied for 220 and 110 volts. Price **£1.80**.

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CN.240/2 Miniature soldering iron 15 watt 240 volts, fitted with nickel plated 3/32" bit and packed in transparent display box. Also available for 220 volts. Price **£1.70**

CN.240 Miniature soldering iron 15 watt 240 volts, fitted with iron coated 3/32" bit. Up to 18 interchangeable spare bits obtainable. This iron can also be supplied for 220, 110, 50 or 24 volts. Price **£1.70**

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CCN.240 New model 15 watt 240 volts miniature soldering iron with ceramic shaft to ensure perfect insulation (4,000 v A.C.). Will solder live transistors in perfect safety: fitted with 3/32" iron coated bit. Spare bits 1/8", 3/16" and 1/4" available. Can also be supplied for 220 volts. Price **£1.80**

CCN.240/7 The same soldering iron fitted with our new 7-star high efficiency bit for very high speed soldering. The triple-coated bits are iron, nickel and chromium plated. Price **£1.95**



SK.2 SOLDERING KIT

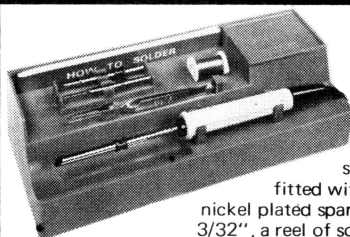
This kit contains a 15 watt 240 volts soldering iron fitted with a 3/16" bit, nickel plated spare bits of 5/32" and 3/32", a reel of solder, Heat Sink, 1 amp fuse and booklet "How to Solder"

Price **£2.40**.



MES.12

A battery operated 12 volts 25 watt soldering iron complete with 15' lead, two crocodile clips for connection to car battery and a booklet "How to Solder" packed in a strong plastic wallet. Price **£1.95**.

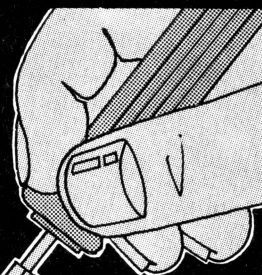


SK.1 SOLDERING KIT

The kit contains a 15 watt 240 volts soldering iron fitted with a 3/16" bit, nickel plated spare bits of 5/32" and 3/32", a reel of solder, heat sink, cleaning pad, stand and booklet "How to Solder". Also available for 220 volts.

Price **£2.75**

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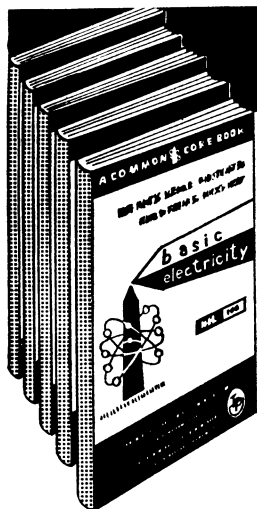
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2N997	17p	2N3702	11p	40348	82p	BCY44	82p	88Y27	17p	NKT613F	82p
2N998	22p	2N3703	11p	40350	82p	BCY45	82p	88Y28	17p	NKT614F	82p
2N706	12p	2N3704	11p	40361	47p	BCY46	82p	88Y29	17p	NKT677F	30p
2N708A	12p	2N3705	10p	40362	47p	BCY47	82p	88Y30	17p	NKT713	35p
2N708	12p	2N3706	09p	40370	37p	BCY70	30p	88Y36	35p	NKT781	30p
2N709	62p	2N3707	11p	40406	47p	BCY71	25p	88Y37	25p	NKT10410	30p
2N718	80p	2N3708	07p	40407	47p	BCY72	17p	88Y38	25p	NKT10439	87p
2N719	80p	2N3709	09p	40408	47p	BCY73	17p	88Y39	25p		
2N727	80p	2N3710	09p	40410	47p	BCY74	17p	88Y40	25p	NKT10519	32p
2N914	17p	2N3711	18p	40467A	80p	BD116	11-12p	88Y51	32p		
2N916	17p	2N3715	11-25	40468A	80p	BD121	60p	88Y52	32p	NKT20829	47p
2N918	80p	2N3716	11-30	40600	87p	BD123	82p	88Y53	32p		
2N929	22p	2N3791	22-08	AC107	80p	BD124	80p	88Y54	40p	NKT20839	47p
2N930	22p	2N3792	22-08	AC108	80p	BD125	80p	88Y55	40p		
2N1090	22p	2N3801	22-08	AC127	35p	BD132	85p	88Y78	47p	NKT80111	77p
2N1091	22p	2N3802	22-08	AC128	35p	BDY10	11-37p	88Y79	47p		
2N1131	22p	2N3804A	27p	AC154	22p	BDY11	11-62p	88Y82	45p	NKT80112	77p
2N1132	22p	2N3805	27p	AC176	25p	BDY17	11-60	88Y90	52p		
2N1302	17p	2N3855A	30p	AC187	82p	BDY18	11-75	88Y95A	52p	NKT80113	77p
2N1303	17p	2N3856A	30p	AC192	82p	BDY19	11-97p	88Y96A	52p		
2N1304	22p	2N3856A	30p	AC197	27p	BDY20	11-12p	BSW70	27p	NKT80211	92p
2N1305	22p	2N3858	25p	ACY18	25p	BDY38	97p	C111	75p		
2N1306	25p	2N3858A	30p	ACY19	25p	BDY60	11-25	C424	27p	NKT80212	92p
2N1307	25p	2N3859	27p	ACY20	25p	BDY61	11-25	C425	25p		
2N1308	30p	2N3859A	32p	ACY21	25p	BDY62	11-20	C426	40p	NKT80213	92p
2N1309	30p	2N3860	30p	ACY22	25p	BDY63	11-25	C428	25p		
2N1507	17p	2N3866	25p	ACY28	25p	BF117	47p	C744	30p	NKT80214	92p
2N1613	25p	2N3877	40p	ACY40	20p	BF163	37p	D16P1	37p		
2N1631	85p	2N3877A	40p	ACY41	20p	BF167	18p	D16P2	40p	NKT80215	92p
2N1632	80p	2N3900	37p	ACY44	40p	BF173	10p	D16P3	40p	NKT80216	92p
2N1638	27p	2N3900A	40p	AD140	52p	BF177	30p	D16P4	40p		
2N1639	27p	2N3901	40p	AD141	52p	BF178	30p	GET102	30p		
2N1671B	21p	2N3903	30p	AD150	30p	BF179	30p	GET113	20p	OC20	75p
2N1711	25p	2N3904	35p	AD161	37p	BF180	35p	GET114	20p	OC22	50p
2N1889	82p	2N3905	37p	AD182	37p	BF181	32p	GET118	20p	OC23	60p
2N1893	82p	2N3906	37p	AF106	42p	BF184	25p	GET119	20p	OC24	60p
2N2147	82p	2N4058	17p	AF114	25p	BF185	42p	GET120	52p	OC25	50p
2N2148	82p	2N4059	10p	AF115	25p	BF194	17p	GET173	12p	OC26	62p
2N2160	82p	2N4060	12p	AF116	25p	BF195	17p	GET880	30p	OC28	62p
2N2193	40p	2N4061	12p	AF117	25p	BF196	42p	GET887	20p	OC29	62p
2N2193A	42p	2N4062	12p	AF118	25p	BF197	42p	GET889	22p	OC35	50p
2N2194	80p	2N4244	47p	AF119	20p	BF198	42p	GET890	22p	OC36	62p
2N2217	27p	2N4285	17p	AF124	22p	BF200	52p	GET896	22p	OC41	62p
2N2218	25p	2N4286	17p	AF125	25p	BF201	52p	GET897	22p	OC42	62p
2N2219	25p	2N4287	17p	AF126	20p	BF223	15p	GET898	22p	OC44	20p
2N2220	25p	2N4288	17p	AF127	17p	BF237	25p	MJ400	11-07p	OC45	12p
2N2221	25p	2N4289	17p	AF139	37p	BF238	25p	MJ420	11-12p	OC46	15p
2N2222	80p	2N4290	17p	AF178	42p	BF244	25p	MJ421	11-12p	OC70	15p
2N2270	47p	2N4291	17p	AF179	72p	BFW61	47p	MJ430	11-02p	OC71	12p
2N2297	80p	2N4292	12p	AF180	52p	BFX12	22p	MJ440	95p	OC72	12p
2N2368	17p	2N4303	47p	AF181	42p	BFX13	22p	MJ480	97p	OC73	12p
2N2369	17p	2N5027	52p	AF239	42p	BFX29	30p	MJ481	11-25	OC78	22p
2N2369A	17p	2N5028	57p	AF279	47p	BFX30	30p	MJ490	11-00	OC78	22p
2N2410	42p	2N5029	47p	AF280	62p	BFX42	37p	MJ491	11-37p	OC77	30p
2N4483	27p	2N5030	42p	AF211	32p	BFX44	37p	MJ1800	12-17p	OC81	20p
2N4484	27p	2N5031	42p	AF212	32p	BFX45	37p	MJ1801	12-17p	OC81D	20p
2N5030	22p	2N5174	52p	ASY27	37p	BFX84	82p	MJ520	60p	OC83	25p
2N5040	22p	2N5175	52p	ASY28	27p	BFX85	32p	MJ521	75p	OC84	25p
2N5041	22p	2N5176	45p	ASY29	27p	BFX86	25p	MPF102	42p	OC139	32p
2N5042	80p	2N5292A	80p	ASY36	25p	BFX87	27p	MPF103	42p	OC140	32p
2N5043	80p	2N5293	80p	ASY37	25p	BFX88	25p	MPF104	47p	OC140	32p
2N5044	80p	2N5294	80p	ASY38	25p	BFX89	25p	MPF105	47p	OC170	80p
2N5045	80p	2N5295	80p	ASY39	25p	BFX90	25p	MPF106	47p	OC70	30p
2N5046	80p	2N5296	80p	ASY40	25p	BFX91	25p	MPF3638	82p	OC201	60p
2N5047	80p	2N5297	80p	ASY41	25p	BFX92	25p	NKT0013	42p	OC202	75p
2N5048	80p	2N5298	80p	ASY42	25p	BFX93	25p	NKT0124	42p	OC203	48p
2N5049	80p	2N5299	80p	ASY43	25p	BFX94	25p	NKT0125	42p	OC204	48p
2N5050	80p	2N5300	80p	ASY44	25p	BFX95	25p	NKT0126	42p	OC205	48p
2N5051	80p	2N5301	80p	ASY45	25p	BFX96	25p	NKT0127	42p	OC206	48p
2N5052	80p	2N5302	80p	ASY46	25p	BFX97	25p	NKT0128	42p	OC207	75p
2N5053	80p	2N5303	80p	ASY47	25p	BFX98	25p	NKT0129	42p	OC208	75p
2N5054	80p	2N5304	80p	ASY48	25p	BFX99	25p	NKT0130	42p	OC209	75p
2N5055	80p	2N5305	80p	ASY49	25p	BFX00	25p	NKT0131	42p	OC210	75p
2N5056	80p	2N5306	80p	ASY50	25p	BFX01	25p	NKT0132	42p	OC211	75p
2N5057	80p	2N5307	80p	ASY51	25p	BFX02	25p	NKT0133	42p	OC212	75p
2N5058	80p	2N5308	80p	ASY52	25p	BFX03	25p	NKT0134	42p	OC213	75p
2N5059	80p	2N5309	80p	ASY53	25p	BFX04	25p	NKT0135	42p	OC214	75p
2N5060	80p	2N5310	80p	ASY54	25p	BFX05	25p	NKT0136	42p	OC215	75p
2N5061	80p	2N5311	80p	ASY55	25p	BFX06	25p	NKT0137	42p	OC216	75p
2N5062	80p	2N5312	80p	ASY56	25p	BFX07	25p	NKT0138	42p	OC217	75p
2N5063	80p	2N5313	80p	ASY57	25p	BFX08	25p	NKT0139	42p	OC218	75p
2N5064	80p	2N5314	80p	ASY58	25p	BFX09	25p	NKT0140	42p	OC219	75p
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2N5078	80p	2N5328	80p	ASY72	25p	BFX23	25p	NKT0154	42p	OC233	75p
2N5079	80p	2N5329	80p	ASY73	25p	BFX24	25p	NKT0155	42p	OC234	75p
2N5080	80p	2N5330	80p	ASY74	25p	BFX25	2				



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PROJECTS...
THEORY.....

THEORY AND PRACTICE

Many an enthusiastic and impatient beginner has no doubt pondered about the importance of theoretical knowledge to the would-be constructor: just how deeply need one go into the seemingly abstruse subject of circuit theory before starting to build electronic projects?

Well, the honest answer is that if one confines oneself to building simple designs, such as described in this magazine, then there is no reason at all why one should not do just this, straight away. The detailed diagrams we provide certainly leave little if anything to doubt; the position of every component is indicated and all wiring connections are clearly shown. The accompanying components list gives in each case all the information necessary when asking for or writing for these items. Yes, it should be possible for most beginners to tackle our projects without delay, even though the technical explanations of the circuit operation may not be comprehensible at this stage.

Provided that proper components have been used and wiring connections made exactly as depicted in the diagrams, correct results should be obtained first time. (The value of checking and rechecking the wiring before connecting the power supply cannot be over emphasised.)

PRACTICAL VALUE

All the above is quite true, yet it must not be interpreted as encouragement to turn a blind eye to theory, to ignore fundamental principles entirely.

There is a perfectly sound and strictly practical reason for acquiring a knowledge of at least the basic principles of electronics as soon as possible. If something does go awry with a project due to a faulty component, even an elementary knowledge of the circuit operation will assist in tracking down the defective part. The remedy, likely as not, will then be simple to effect. But without that certain amount of basic knowledge one is of course confronted with an enigma that defies solution.

A BIGGER VIEW

Apart from facilitating fault-finding, an appreciation of the manner in which the circuit operates adds greatly to the general enjoyment one can derive from this hobby. The more advanced one's knowledge, the more attractive electronics becomes. An ever extending vista of interesting and tempting applications is seen as understanding of electronic fundamentals grows.

So, beginners, by all means have a go with the project of your choice. But do also take advantage of our tutorial series *Teach-In*. Then in a short while those circuit descriptions will become less mysterious and each circuit diagram will have its own interesting story to tell.



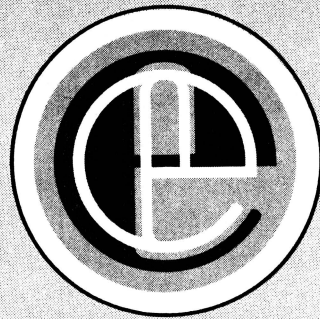
Our March issue will be published on Friday, February 18

EDITOR F. E. BENNETT • M. KENWARD • B. W. TERRELL B.Sc.
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Everyday Electronics, Fleetway House, Farringdon Street, London, E.C.4. Phone: Editorial 01-634-4452; Advertisements 01-634-4202.



..EASY TO CONSTRUCT ..SIMPLY EXPLAINED

VOL. 1 NO. 4

FEBRUARY 1972

CONSTRUCTIONAL PROJECTS

AUTO ALERT <i>The motorist's "dead man's handle" by David C. Dick</i>	190
RADIO CONTROL MONITOR <i>For testing transmitter function by F. G. Rayer</i>	195
RAIN WARNING ALARM <i>Protect the washing by Frank Brown</i>	208
WAA-WAA PEDAL <i>Musical effect for guitars and organs by P. J. Tyrrell</i>	214

GENERAL FEATURES

EDITORIAL	188
RUMINATIONS <i>by Sensor</i>	194
DIGITAL COMPUTERS <i>by C. N. Seal and A. Smith</i>	198
TEACH-IN <i>Part 4 : Power by Mike Hughes</i>	203
USING STICK DOWN WIRING	212
ACTION ! <i>An evening class visited</i>	218
MEMORY STORE <i>Retrieval by Dick Railton</i>	221
ABBREVIATIONS	221
SHOP TALK <i>Component buying by Mike Kenward</i>	222
READERS' LETTERS	225

Approximate cost of components



The approximate cost of components given, for constructional articles, in the box shown opposite is an estimated cost compiled from suppliers current catalogue and advertised prices. Parts for some projects may work out more expensive while others may be cheaper than our quoted price, depending on where the components are purchased.

We would like to point out that we, as publishers, cannot supply kits of parts or individual items for any of the published designs.

AUTO ALERT

FOR MOTORWAY
DRIVING

By David C. Dick

Approximate cost of components



2.50 inclusive

Keep a check on your awareness. The Auto Alert provides added safety for all long distance drivers.

WITH the ever-increasing growth of new dual carriageway roads and motorways, the average car driver is tempted to travel longer distances than he would previously have tackled.

The urge to "do the whole journey in one go" or to "cover the distance at night while the roads are quiet" has involved many a motorist in a nasty and often lethal accident. The tedium of a long unbroken motorway journey, the monotony of night driving, the hypnotic swishing of windscreen wipers and the blow of warm air from the heater are all possible causes of that lack of concentration (or even nodding off!) which at motorway speeds can be the cause of an extremely dangerous situation.

"DEAD MANS HANDLE"

The "dead man's handle" is the name given to a particular kind of footswitch which is fitted in the driver's cab of modern locomotives. The switch has a middle off position and the driver has to keep it in the middle position in normal driving. If the driver should faint or take ill his foot will either press the pedal fully down or his foot will lift off the pedal. Either way a contact is made and a warning klaxon sounds in the driver's cab. After a certain delay, if the pedal is not reset, the train's braking system will come on automatically.

A footswitch of this kind cannot be fitted in a car as the driver's left foot will be needed from time to time to press the clutch for gear changes and to operate the headlamp dip switch. However, the principle of the switch is a good one and can be adapted for use in a car.

CAR SYSTEM

The Auto Alert consists of a timing unit and two relays that are used to turn on a warning light and to sound the car horn. The Alert is turned on and a push-button or footswitch (whichever is preferred) is depressed to set the circuit. After a predetermined time interval the

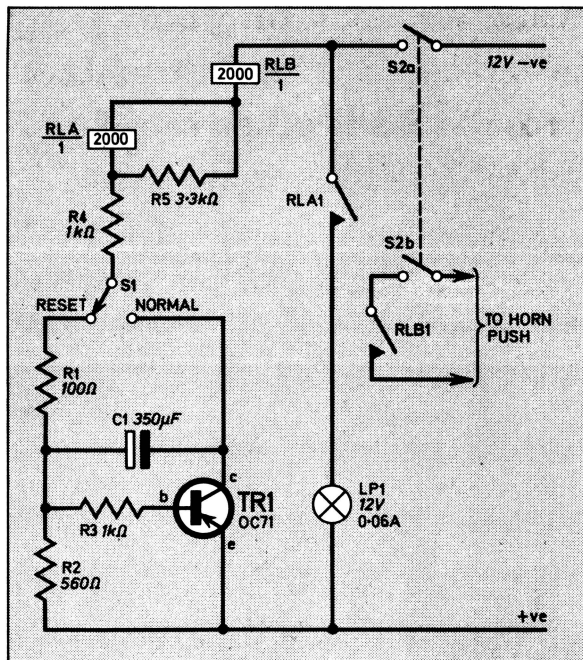


Fig. 1. Complete circuit diagram of the Auto Alert. S1 is the push button or footswitch that resets the unit.

Components....

Resistors

R1	100Ω
R2	560Ω
R3	1kΩ
R4	1kΩ
R5	3.3kΩ

All $\frac{1}{2}$ Watt $\pm 10\%$ carbon

Capacitor

C1	350 μ F elect, 15V
----	------------------------

Transistor

OC71	Germanium pnp
------	---------------

Switches

- S1 Single pole double throw micro-switch or push button (see text)
- S2 Double pole single throw car type toggle

Relays

- RLA G.P.O. 3000 type, 2,000 ohm coil with single pole normally closed contacts
- RLB G.P.O. 3000 type, 2,000 ohm coil with heavy duty single pole normally closed contacts

Miscellaneous

- LP1 12V bulb and holder
- Car switch panel—two hole type (see text)
- Metal brackets (2 off see text)
- 10 way connecting strip, hardboard, connecting wire and 4BA fixings
- Materials for foot switch if used (see text and Fig. 5)

Shop Talk Refers

light on the Alert will come on and the driver should press the switch to reset the Alert. If, due to lack of concentration, the driver fails to notice the light and does not press the switch then, after a further short interval, the car horn will sound to warn the driver.

Thus a regular check is kept on the concentration of the driver and any tendency to lose concentration will be noticed before it gets to the eyelid drooping or daydream driving stage.

It is important that the unit is not regarded as an automatic "waker-upper". The first time that the horn operates the driver must take the warning, pull off the road and not drive again until he is sure that he is sufficiently alert.

CIRCUIT OPERATION

Assume the circuit (Fig. 1) to be in the "normal" condition with C1 fully discharged. When voltage is applied TR1 will be passing current due to the voltage at its base being the same as at the collector. As C1 gradually charges up TR1 will slowly turn off and the current passing through the relays will diminish. As resistor R5 is fitted across the coil of RLA the current flowing through RLA at any time will be less than that flowing through RLB; thus RLA will drop out before RLB.

When RLA contacts close lamp LP1 will light and, unless this is noticed within approximately 20 seconds, RLB contacts will also close and sound the car horn. If, however, the light is noticed and the reset button pressed, the circuit will return to the "normal" position (C1 fully discharged) by the following method.

With S1 in the reset position C1, which is now charged up, provides the collector voltage. To discharge C1, TR1 must conduct and it does so because R1 and R2 form a potential divider across the supply so that a negative voltage is applied to the base. Capacitor C1 then discharges through TR1 and R2. During the "reset" time current passing through R1 and R2 will keep both relays energised, so preventing the horn from sounding and extinguishing the warning lamp LP1.

Variation of the value of C1 will alter the time interval—increase C1 to increase the time and decrease C1 to decrease the time.

CONSTRUCTION

The design of the unit was drawn up to enable it to be constructed with only a minimum of skills. First, take a two-hole car switch panel; this is available from any car accessories shop and already has two holes drilled in the outer face with two smaller holes drilled in the top lip. The two larger holes in the face will be used for mounting the switch S2 (see Fig. 3) and the lampholder for lamp LP1. The next components to be fitted are the two metal brackets. The brackets used in the prototype were bought

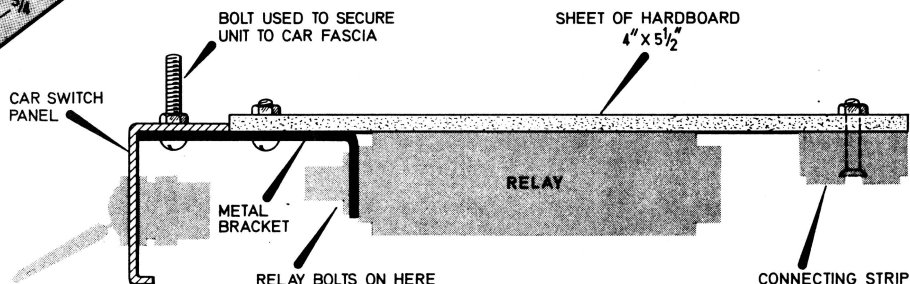
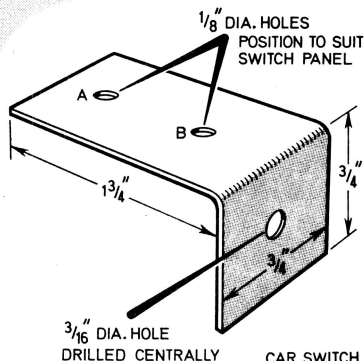
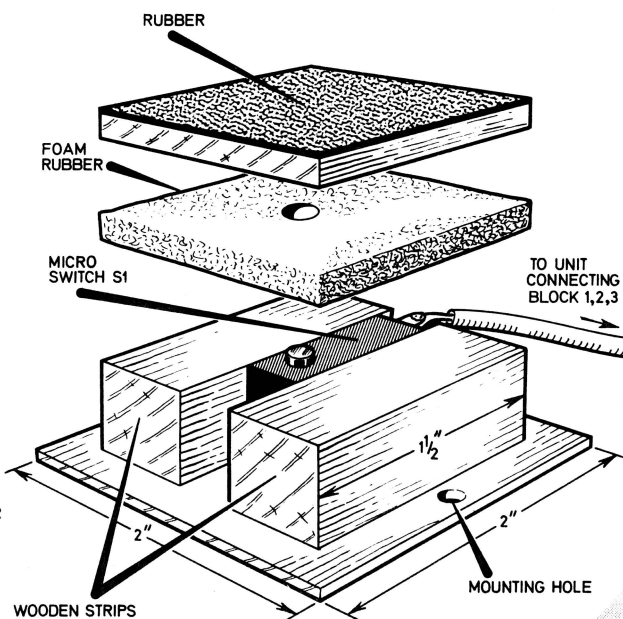
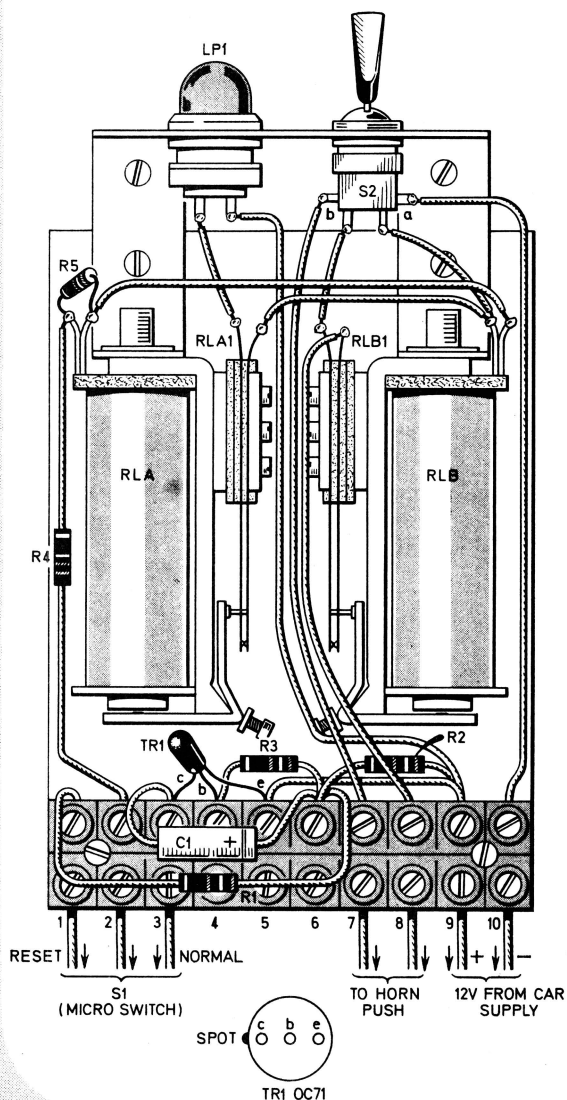


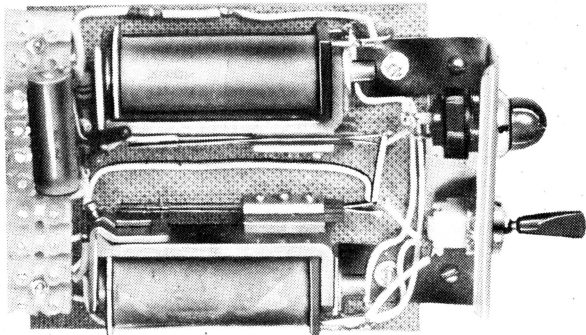
Fig. 2. (top left) Mounting bracket for relays RLA and RLB.

Fig. 3. (above) Showing how the mechanical parts fit together.

Fig. 4 (left) Layout and wiring of all components except SI. The wire from position 2 on the connecting strip goes to the centre contact of SI.

Fig. 5 (below) Construction of the foot switch.





Prototype Auto Alert. Switch S1 and some of the wiring has been slightly modified.

ready drilled from Woolworths for a few pence each. If these are not available they can be made from the measurements given in Fig. 2.

Using two 1 inch long bolts, bolt together the switch panel and the two brackets. The longest legs of the brackets are placed under the top lip of the switch panel (see Fig. 3) and the bolts are placed up through holes "a" in the brackets. The excess length of these bolts will be used later to secure the entire completed unit to the underside of the car dashboard.

A sheet of hardboard measuring 4 inches by 5½ inches is next bolted to the brackets using the remaining small holes "b" in the brackets (see Fig. 3). The hardboard will act as a baseboard for the circuitry and as a dust cover for the relay contacts and other components. A ten-way screw connecting strip is bolted across the bottom of the baseboard as in Fig. 4. This connecting strip is used to mount the components in preference to a conventional tag strip as this makes for easier fitting of the complete unit into the car. If constructors have facilities for soldering in the car (a 12 volt soldering iron or an extension mains lead, for example) then they may prefer to use a normal tag strip and solder all the connections.

We are now ready to mount the components. The lampholder and switch S2 should be mounted on the switch panel, and the two relays are fixed to the brackets.

RELAYS

At the end of the relay next to the coils and spring set tags, there is a square of paxolin with three holes drilled in it. Through the two outer holes are screws which are normally used for the mounting of the relay. These two screws and the paxolin square can be removed as they will not be used. This leaves a circular nut which is used to hold the coil core to the relay frame. This nut should be undone and the bolt from the relay coil passed through the remaining hole in the bracket. The nut should then be screwed back on using a washer. Both relays are thus held

securely to the unit. See Figs. 3 and 4.

The relays purchased for the prototype were fitted with further contacts; in this case the unwanted layers of spring contacts should be removed otherwise the relay will not operate at the low current necessary. Relay RLB is used to switch the horn and as the horn takes a substantial current it is considered necessary to fit heavy-duty relay contacts to handle the current. It should be remembered, however, that the relay should hardly ever be used to switch on the horn and therefore heavy-duty contacts are not essential.

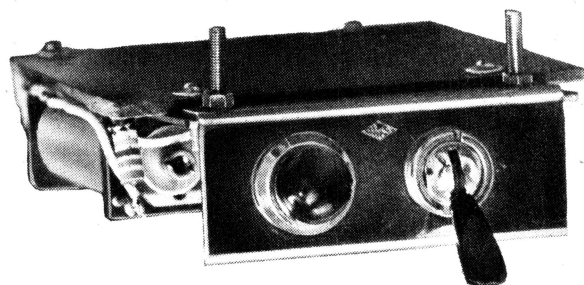
WIRING

The wiring should be carried out as in Fig. 4. Where more than one wire goes into one hole of the connecting strip it is a good idea to solder the wires together before screwing down. This will improve future fault liability.

Remember to connect the electrolytic capacitor in the correct polarity. Also it is important to connect the transistor in the manner given in the diagram. The red spot of the transistor body is at the side next to the collector lead and the base connection is the middle lead. If the leads are reversed the unit will not work and it is probable that the transistor will be destroyed. If you construct the unit using a tag strip or solder the connections affix the transistor after completing the wiring and hold each lead in a small pair of pliers while soldering to prevent overheating and thus damaging the transistor.

RESET SWITCH

Either a footswitch or a dashswitch can be used for S1. The cover illustration depicts a dash-mounted push-button and lamp. If such an arrangement is required the on/off switch and the unit can be placed in the car dash panel and the lamp and push-button can be mounted remotely in a convenient position or with the on/off switch in the panel. A micro-switch is probably best used with the footswitch design given and a normal change-over push-button (momentary contact type) used for a dash-mounted button.



THE FOOTSWITCH

The construction of the footswitch is shown in Fig. 5. The micro-switch is held between two strips of wood, each strip being approximately 1½ inches long and of the same height as the micro-switch body. This means that the operating plunger of the micro-switch will protrude above the level of the wood strips. It was found sufficient to glue the pieces together with Evo-Stik, and this gave a permanent joint. The completed piece can then be glued to the base section. The base section is 2 inches square and can be constructed from any kind of material; in the prototype a piece of hardboard was used. The base should have two holes drilled in it as in Fig. 5, these holes will be used later for fixing the switch to the car floor.

Next, a piece of foam rubber, ½ inch thick and 1½ inches square, should be glued across the wood strips, a hole being cut in the foam around the micro-switch plunger. On top of the foam rubber another piece of hardboard 1½ inches square is glued, this piece of hardboard is covered with rubber to prevent slipping. The footswitch is now complete and can be screwed to the car floor with self-tapping screws.

FITTING

Before fitting carefully check the wiring for any mistakes. Two holes should be drilled in the underside of the car dashboard and the two bolts from the unit pushed through the holes and secured with nuts, preferably using spring or serrated washers. The wiring from the footswitch should now be brought up to the unit and screwed into the connecting strip at the appropriate points. To make the wiring inconspicuous, it can be taken up under carpets, where this is convenient. Wires can now be taken from the unit to the horn wiring and to the supply.

The two leads from the unit to the horn push are connected across the push, the polarity does not matter (one side of the push may be connected to earth). Supply wiring will depend on the earth polarity of the car and this should be checked before connecting the unit. The live supply can be taken from the ignition switch.

Once the wiring to the car is complete the unit is ready for use, press the reset button and hold it pressed until the unit is turned on, then release and check the function of the unit. Remember do not keep your foot on the reset button all the time and do not use the Alert to keep you awake. □

Ruminations

By Sensor

An Act of Charity

I thumped the television set on the top right hand corner. That was two months ago and since then it has behaved itself. There was a shift in the tuning position of the three programmes, but the set has remained stable. I did not strike it in anger, although in the circumstances one might have been forgiven for doing so, for it had developed an intermittent fault that caused it to go out of tune, losing sound and vision, usually during the news or when Bamber Gascoigne was giving the answer to one of the "University Challenge" questions. The trouble never occurred during the advertisements. Such behaviour could not be allowed to continue, I had to act.

The set is on rental. I ought to have sent for the service engineer, but I know from my own experience that intermittent

faults are the most time consuming and frustrating aspects of a serviceman's life, or indeed, of anyone concerned with the reliability and maintenance of electronic equipment. Such faults often fail to appear when the engineer is called but can be depended upon to show up when his van has turned the corner.

Even if the fault does appear in the presence of the serviceman the slight disturbance created by the action of removing the back of the set or of connecting a test meter will often cause it to disappear again. Many of these intermittent faults are caused by "dry" joints (badly soldered connections which develop into high resistance joints after a period of time) and although there are techniques that can aid the serviceman, the diagnostic procedure is largely a matter of poking, prodding, tapping and on occasion, "thumping" various parts of the set, coupled with a keen visual inspection of the soldered joints.

This last is far from easy when the set has been in use for some time and has accumulated a thick layer of grime over the component boards. The idea

behind the tapping and thumping business is to cause the fault to appear so that it can be diagnosed by conventional methods; this is why I thumped my television—to present the serviceman with an easier job! However, I achieved a temporary "cure" instead. How long it will last is anyone's guess.

An Uplifting Experience

Low insulation resistance can cause strange and sometimes dangerous faults to develop. An acquaintance of mine who worked for the electricity board was sent to investigate a complaint made by the trustees of an old chapel. It was alleged that ladies using the chapel toilet had received electric shocks.

My acquaintance, rather daringly, poured a bucket of water down the toilet and was rewarded for his boldness by a mild but stimulating electric shock. It was discovered that the insulation of some nearby cable had deteriorated and an earth leak had developed via the concrete floor. Users of the toilet thus formed a parallel path for the leakage current, with disconcerting but fortunately not disastrous results.

RADIO CONTROL MONITOR

Provides a quick check on radio control transmitter function. Pocket size and self powered for ease of operation "in the field."

By F. G. Rayer, A.I.E.R.E.

THE 27MHz radio frequency (r.f.) band used for the control of models by radio, extends from 26.96MHz to 27.28MHz; transmissions for this purpose may consist of an unmodulated carrier wave, or a carrier wave which is modulated by one or more audio frequency tones. Signals which are radiated by the transmitter can be checked with a monitor.

The simple monitor described here is self powered and of compact size, so it can readily be carried out of doors, with the transmitter, model and other equipment. It allows a quick check of normal carrier-wave power and frequency, and of any audio modulation tones which may be used.



CIRCUIT

The complete circuit is shown in Fig. 1. A coil consisting of three windings, L1, L2 and L3 forms the basis of the circuit. L1 is the tuned winding, and the operating frequency is set to that of the transmitter by means of the trimmer C1. With the coil and trimmer described, the whole of the model control band is easily covered. When the transmitter and the tuned circuit (L1 and C1) are set to the same frequency, and the monitor is held in a position where it picks up sufficient r.f. (radio frequency) energy, L1 absorbs some of the power from the transmitter. The monitor has two indicating devices, operated by the power absorbed.

Winding L2 is inductively coupled to L1 and when L1 absorbs r.f. power this is induced in L2 and provides current for the small lamp LP1. Resonance between the transmitter and monitor frequencies is shown by maximum brightness of this lamp. The brightness of the lamp also shows that the transmitter is producing its normal r.f. power.

Winding L3, with the diode D1 and earpiece TL1, give audible monitoring of the tones produced by the transmitter. So the control and tone-producing circuits of the transmitter can be immediately checked, by listening with the earpiece. The diode acts as a detector to extract the audio signal from the amplitude modulated r.f. signal that the transmitter provides.

Some changes in components will not unduly affect the circuit. The earpiece TL1 can be between 35 and 250 ohms impedance, of the kind used with transistor radio receivers. It would also be quite possible to use a different wire gauge or tube size for the coil, although some experiment with the number of turns would then be necessary.

The lamp must be a low-consumption type; a 6 volt 0.04 amp bulb, as used for cycle dynamo rear lamps, is most suitable, but a 6V 0.06A could be used. Bulbs which take the smallest current will give the more sensitive indication.

CONSTRUCTIONAL DETAILS

The monitor is constructed to the details shown in Fig. 2, then inserted in a 3½ inch long by 1¼ inch diameter paxolin tube.

A piece is 1/16 inch thick paxolin 3½ inches long is cut to such a width that it is a tight fit inside the 1¼ inch tube. For part of its length the paxolin is further reduced in width, so that it fits tightly inside a 1 inch diameter paxolin tube. The paxolin sheet is best cut slightly over-size, and then filed to fit.

The 1 inch diameter tube that is the coil former is 1 inch long. All windings are of 24 s.w.g. enamelled copper wire, wound side by side. Drill six 1/16 inch holes in the tube as shown in Fig. 2, thread the wire through hole A, smear part of the tube with Bostik 1, or similar adhesive or cement, and wind on nine turns to form L1,

R.C. MONITOR

Approximate cost of components

£

1.30 inclusive

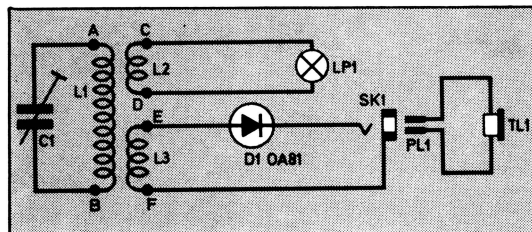
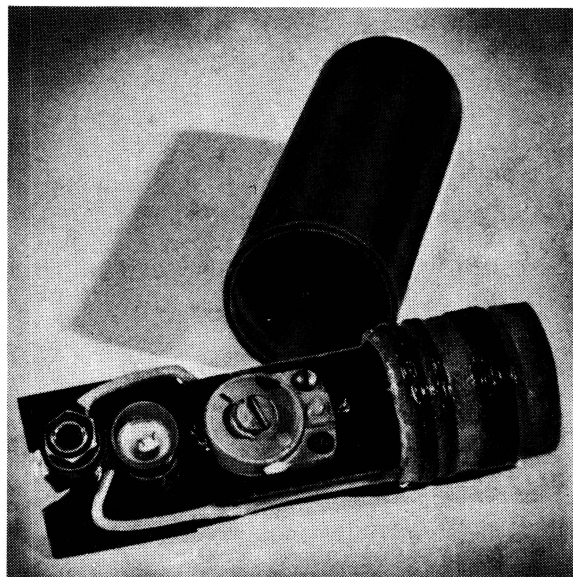


Fig. 1. Complete circuit diagram of the Radio Control Monitor.

Components....

Capacitor

C1 6—25pF ceramic trimmer

Diode

D1 OA81

Shop Talk
refers

Lamp

LP1 6V 0.04A screw in bulb (see text)

Earpiece

TL1 35Ω to 250Ω earpiece with miniature jack plug (PL1)

Socket

SK1 Miniature jack socket to suit earpiece plug

Miscellaneous

24 s.w.g. enamelled copper wire
P.V.C. covered connecting wire
 $\frac{1}{16}$ inch s.r.b.p. or paxolin board $3\frac{1}{2}$ in. x $1\frac{1}{2}$ in.
Thin paxolin $1\frac{1}{4}$ in. square for end pieces (2 off)
Paxolin tube 1 in. x 1 in. diameter and $3\frac{1}{2}$ in. x $1\frac{1}{2}$ in. diameter

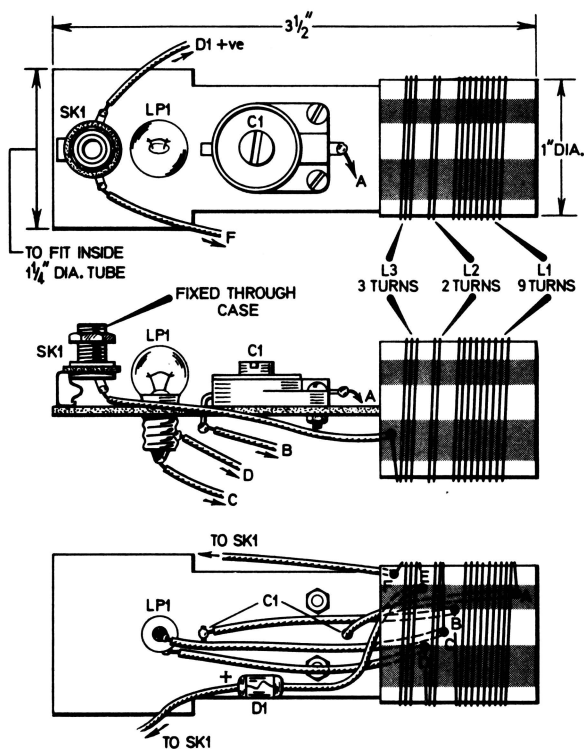


Fig. 2. Constructional details showing the complete unit without the case. The three views show the top, side and underside of the unit. SK1 is mounted through the outer case.

finishing by pulling the end through hole B. Make L2 (two turns) and L3 (three turns) the same way.

The tube is then cemented in place on the panel, with the wire ends running back (as shown in Fig. 2) identified with coloured 1mm p.v.c. sleeving. The lamp LP1, is a screw fit in a hole drilled through the panel. Leads C and D are soldered to its side and end pip. Since, with careful use, the bulb should never need replacing, this method of fixing is suitable. Two 8BA bolts hold the trimmer, and the miniature jack socket is fitted through a hole in the outer tube.

TESTING

To test the monitor, set the trimmer about half open, using a non-inductive trimming tool, and bring the monitor coil into the field of the transmitter aerial (tank) coil. Rotate the trimmer with the trimming tool to tune L1 to resonance with the transmitter; this is shown by maximum brilliance of the lamp. At the same time move the monitor away from the transmitter coil, as required, so that the bulb only glows dimly.

If the transmitter is of a type producing audio tones, plug in the earpiece, operate the transmitter, and listen for the audio signals.

Slight re-adjustment of the trimmer is necessary after the monitor has been fitted in its protective case. The tubular case has a $\frac{1}{4}$ inch hole for the jack socket, a similar hole through which to see the lamp filament, and a third smaller hole allowing the trimmer to be adjusted with a trimming tool. Both ends of the tube are closed with paxolin discs cemented on. The tubular case must not be made of metal of any type.

METHOD OF USE

The monitor is held by the jack end, and its coil brought near the power amplifier or tank coil of the model control transmitter. The trimmer is adjusted with a non-inductive trimming tool, and tuning should be quite sharp. Move the monitor slightly away from the transmitter, so that LP1 filament only just glows at the correct tuning point. This gives the sharpest resonance indication, and avoids blowing the filament.

If the transmitter is totally enclosed in such a way that the tank coil cannot be approached, a loop consisting of one or two turns of insulated wire can be placed in the aerial connection, and the monitor approached to this.

If the transmitter has variable frequency tuning, as with self-energised oscillators, a check on transmitter frequency can be made by noting that its tuning agrees with maximum brilliance of the lamp, keeping coupling loose.

Where the transmitter has tuning adjustments which govern the output power, note that these are set so that the lamp lights with its usual brightness. For tone transmitters, plug in the earpiece and listen in turn for each normal tone. Lack of any indication at all will show that the transmitter has failed. □



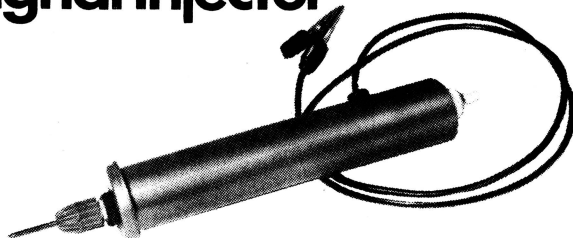
Soil Moisture Meter

Don't kill your plants by over-watering—plants of different species have their own requirements. This meter measures soil moisture at root depth.

Darkroom Timer

Do your own printing? Then this timer is for you; it has switched positions to cover the range of times normally used for exposures in the darkroom.

Signal Injector

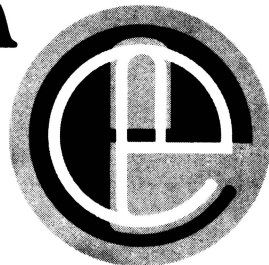



For fault finding in radio's and amplifiers.

ALL FEATURED IN THE March ISSUE OF

On sale

Friday February 18.





DIGITAL COMPUTERS

By C. N. Seal
and A. Smith

MANY aspects of modern life use a computer; more and more of us find that computers have become part of our everyday lives. We feel their effect most in the management of our financial affairs. Our cheques are processed by computers which read magnetic ink patterns printed on the cheques; internal banking transactions, such as transfers from one account to another, are performed by computer. Our salaries, with bonus, overtime, and other remunerations, are calculated by computers which also deduct tax, National Insurance contributions, and so on. Details are then printed onto our payslips and salary cheques.

Invoices are processed and printed by computers which also calculate and subtract discounts, and prepare all necessary bills. Large scale industrial control can be performed continuously by computers in places such as oil refineries, steel mills, breweries, car manufacturing plants, and so on.

Any of you that have travelled by air would probably have had all details of your booking stored in a computer. At each booking point there would be a computer terminal—a link between the booking clerk and the computer—which indicates details of any flight, and in particular, whether there are any spare seats available.

Computer terminals are not confined to airline booking offices. Many small companies with a

need for computer aid, but without the necessary funds to own their own computer system, utilise a time-sharing process. These users each have a remote terminal linked to the central computer system via the Post Office telephone lines.

The computers used for these systems are capable of processing several different user's programmes, apparently simultaneously. This is called multiprogramming. The link between the terminal and the computer is made after the operator has dialled the correct number on a conventional telephone. The time taken for processing the customers programme is recorded, and is consequently used to determine the cost.

DEFINITION

A computer may be defined as a device capable of automatically accepting data, applying a sequence of processes to the data, and supplying the results of these processes to its user. There are basically two types of electronic computer; analogue and digital.

Heading photograph. Magnetic discs and tapes can store massive amounts of information. Each of the disc drives in the foreground can store 18.4 million characters of data, enough to store the entire contents of the Bible twice. The tape drives at the rear can store 14 million characters. (Honeywell Information Systems Ltd.)

An analogue computer is a machine in which the value of a signal is proportional to the value which it represents. Such a signal is continuously variable, and may take any one of a large number of possible values. For instance, a car engine tachometer reading reflects the changes in the engine rotational rate. The indication is analogous to engine speed.

In contrast to the analogue signal, the digital signal has a discrete numerical value. It either exists and has one value, or it does not exist and has another value. This gives us the two "states" we require for use in the digital computer. A positive signal can represent the figure one, and no signal can represent zero.

DIGITAL COMPUTER

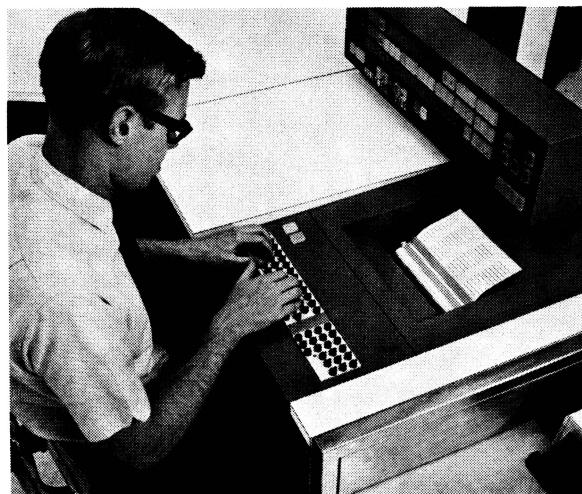
For the purposes of this article we shall only consider the digital computer. To understand digital computer functioning we must first appreciate the number system used for making the calculations.

The earliest system resulted from man's desire to know "how many." To answer this he used the tally system; for each item counted he made a mark, or tally. Whilst providing some means of measuring, this system proved very limited and unwieldy for even comparatively small numbers.

For convenience we now use the decimal system which runs through a cycle of ten symbols before any are repeated. It is said to have a base of ten. Any decimal number can be broken down into a number of tens, a number of tens of tens (hundreds), and so on.

Although the decimal system is logical and consistent, it requires the use of ten digits which makes it unsuitable for electronic representa-

The cleanliness of the modern computer room can be seen here. The girl operator is using the keyboard to enter information into the computer memory. (International Computers Ltd.)



An operator uses a console to write instructions directly into the main or control memory areas of the computer. (Honeywell Information Systems Ltd.)

tion. We must, therefore, study an alternative system which we call binary.

In the binary system the base number is two, and each binary digit, or bit, can only have one of two possible values, zero or one. The rules for the construction of this system are similar to those for decimal, as also are the rules for addition and subtraction; we just carry when the count becomes greater than one, or borrow two instead of ten.

As the numerical value increases, the number of bits required to represent it also increases. In the computer we must restrict the number of bits per character or per word to keep the calculations manageable. Usually computers confine the length of a character or a word to between six and forty bits.

SOFTWARE

Software is a term describing the programme of instructions, usually supplied by the computer manufacturer, to enable communication with the computer and control of its operation. So great is the importance of software that investment in its production represents a high percentage of funds allocated for design, development, and marketing of computer systems. Indeed, computer sales can depend on the availability and versatility of the software, and not on the hardware—the mechanical and electronic parts of a computer.

Software includes all manner of operating procedures and programmes, such as assemblers or compilers—programmes which convert programmes written in symbolic languages such as FORTRAN and COBOL into the machine code required by the computer.

Other types of programmes include Executives—programmes which control the operation



A pair of visual display units are shown here against a background of magnetic tape drives. Information is shown on the face of a cathode ray tube, as in a television set. (Burroughs Machines Ltd.)

of other programmes; Subroutines—programmes designed to perform routine calculations; and Diagnostic Routines—programmes used by the service engineer to facilitate fault finding, and to indicate whether the system is functioning correctly.

Assemblers, Executives, and Subroutines form part of a processing package—a software package enabling the user to fulfil his data processing requirements. This package is normally called an Applications Package, and is software written especially to the users own requirements.

As previously mentioned, hardware comprises the physical units in a computer system—the mechanical and electronic assemblies.

HARDWARE

Computer system hardware consists of two main areas. The first is the Central Processor, more commonly called the C.P. which performs all the major calculative and control functions. We shall consider C.P. operation later in this article. The second area embraces the peripherals commonly called input/output devices.

PERIPHERALS

To place a programme and the associated data into the C.P., we must have some form of reading, or input device. The commonest input device is the operators keyboard, or console, which enables direct manual communication with the C.P. It is generally used to instruct the C.P. to read data from an input source, or to input parameters and additional data during programme runs.

The information typed into the keyboard, or console, may be printed on paper, or displayed on a television monitor type unit which presents

the information on the screen of a cathode ray tube.

There are basically four methods of supplying new data to the computer. The most common method is probably the punched card.

PUNCHED CARD

This is a card containing rows and columns punched with holes in the required code. Punched card readers can have either optical or mechanical reading arrangements.

Optical readers contain lamps and photocells arranged so that the card passing between them causes a pulse of light for each hole detected.

In the mechanical systems, the card passes between a set of contacts and metal fingers which press lightly against the card. When a hole passes a contact the finger is allowed to press against the contact and complete the circuit.

Speeds of card readers vary between 400 and 1,000 cards per minute, with about 800 cards per minute being typical. The cards are relatively cheap, easy to sort, and in some cases the data contained on the card is printed along the top edge allowing the card to be read visually. However, they are bulky, making them difficult to store. They are affected by atmospheric conditions, particularly humidity, and are easily damaged.

PUNCHED TAPE

Punched paper-tape is another common input medium. The tape is normally a one inch wide strip of paper-tape on a spool. The data is contained in rows, or frames, punched in a computer readable code. Tape is often produced by other devices, such as a typewriter or cash register. Tape readers are normally optical devices, operating similarly to the optical card reader.

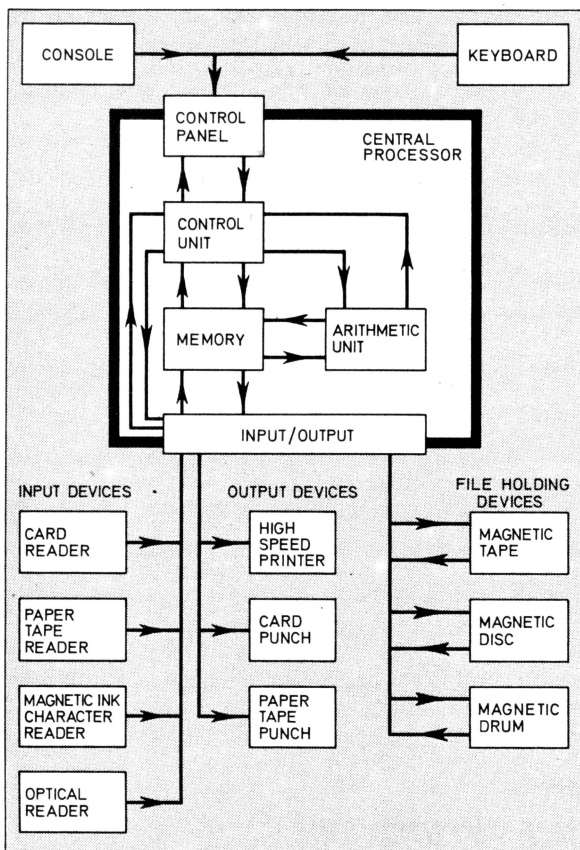
Tape readers can operate at speeds of between 300 and 2,000 frames per second, with around 1,000 frames per second being typical. Paper tape is inexpensive, but because the data is punched serially it cannot easily be amended.

MAGNETIC INK READERS

Magnetic ink character readers enable cheques and similar documents to be read. Each cheque contains a series of numbers printed in magnetic ink. The reader senses the shape of the magnetic field emitted by each character. Cheque readers can process up to 1,600 cheques per minute.

OPTICAL READERS

Optical character readers have not yet been fully developed as a method of reading handwriting, such as signatures, but most in use are able to read standard shaped letters of the alphabet, using a photoelectric cell to scan characters



This illustrates the general organisation of a typical computer system. Major data and control paths are indicated. A system may use some, or all of the input and output devices, and in the case of the file holding devices, the system may utilise a number of each type.

printed in ordinary black ink.

The devices mentioned so far have been input devices, supplying data to the computer. Punched cards and paper tape can also be used to take data from the computer. Card and tape punches are, however, rather slower than the readers.

OUTPUT

The commonest output device is the high speed line-printer. This is a machine which types the data onto paper in complete lines, instead of a character at a time. Speeds vary from 300 lines per minute to around 1,500 lines per minute, with 650 lines per minute being typical. A line can be up to 132 characters wide.

These high printing speeds are extremely useful where large quantities of information are required. A line-printer is considered essential for all commercial computer applications, for presentation of report and analysis details, and financial statements.



A finance company uses this large computer installation for the maintenance of the accounts for customers and dealers. The system uses a variety of peripheral devices, including a high speed printer, magnetic tape drives, magnetic disc drives and a paper tape reader. (The National Cash Register Company Ltd.)

STORAGE

The third group of peripherals are known as storage, or file holding devices, and are input and output devices. These peripherals operate on similar principles to the domestic tape recorder, by placing a pattern of magnetic fields on a ferrous oxide surface.

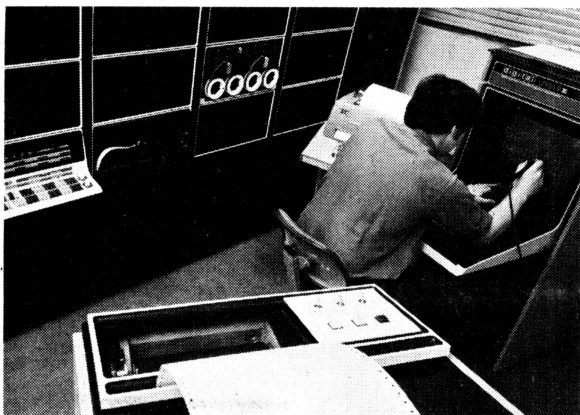
Magnetic recording tape is similar to domestic recording tape, but has a finer grade of oxide coating enabling a higher density of data to be held. It is also wider than domestic tape, $\frac{1}{2}$ inch being a standard.

The data is recorded in serial form, and consequently, if some data near the end of the tape is required, some time is taken to reach it—this is called the “data access” time. This is ideal for storing information used in a serial form, such as programmes.

Magnetic discs, another storage device and much faster access time than any other type, look similar to a stack of records on an auto-changer spindle. Both side of each disc are coated with oxide. Read/write heads project into the gaps between pairs of discs and can read from, or write to, both discs.

The magnetic discs revolve at a very high set speed, and by synchronising the head position, information can be read, or written. This type of device is called a direct access device because any item of data can be found easily and quickly.

Magnetic drums are cylinders coated with ferrous oxide on the outside. Read/write heads are spread along the length of the drum, and as the drum rotates at a set speed, data is transferred to, or from the required area of the drum.



An engineer uses a light pen to amend an engineering diagram. This system is used in the development of printed and integrated circuits. (Digital Equipment Company Ltd.)

CENTRAL PROCESSOR

The central processor unit, or C.P. is the nerve centre of a computer operation. It is here that all calculative and control functions are performed. To do this the C.P. must contain four essential circuit areas. These are; memory, control, arithmetic, and input/output.

When we make any sort of calculation we must have some means of retaining the facts required to arrive at the solution. We use our brain when doing this manually, or perhaps a pencil and paper for the more complex operations. The combination of these could be called our memory unit. The computer memory performs this type of function. It is simply an area in which it can store the data, the programme to process the data, and the results obtained.

MEMORY

The computer memory is like a large electronic filing system. It contains hundreds of "memory locations", each with an exclusive address, and each capable of containing one data statement, or a programme command.

Each location consists of a number of magnetic cores, which are minute ferrous oxide impregnated rings. Each binary bit is stored in one of these cores, and can be read in less than one microsecond.

The programmer arranges his programme so that the instructions occupy a sequential block of memory locations. When the programme is run the address of the first location is entered into a programme counter. As each instruction is executed the counter is incremented, and therefore contains the address of the next instruction. Consequently the machine can complete all the required calculations automatically.

An instruction to the computer does not contain the data that is to be processed, but the address of the location in the memory.

When executing the instruction, the computer

control takes the data from memory, and moves it to the arithmetic area for modification as prescribed by the instruction.

ARITHMETIC UNIT

The arithmetic unit of the C.P. is the work-horse area in which all calculations are carried out. It consists basically of an accumulator, or a number of accumulators, and an adding network.

To add two numbers together the machine takes the first number from memory and places it in the accumulator. The second number is then removed from memory, added to the accumulator and the sum of the two is retained in the accumulator. The result may then be stored in a new memory location to leave the arithmetic unit free to continue other processes.

CONTROL UNIT

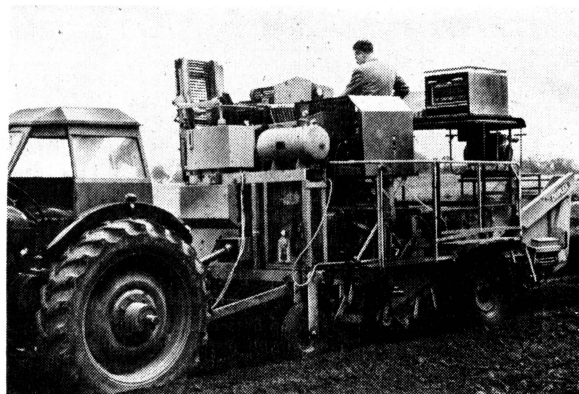
All the data movements and manipulations must be correctly sequenced and routed. This is the task of the control unit which acts as switching device. As each programmed instruction is extracted from the memory it is translated into a series of actions which direct the memory and arithmetic units to supply and process the appropriate data. The control unit also directs the input/output unit when an instruction requires action on the part of a peripheral device.

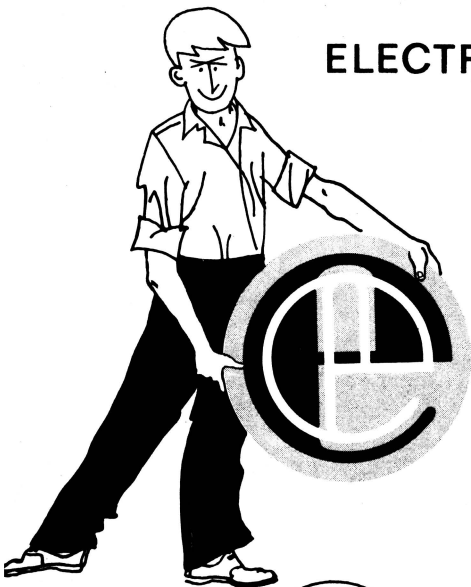
THE FUTURE

Future developments look towards the building of smaller computers. Increased use of integrated circuits has already caused the central processor to become one of the physically smaller units of a system.

It appears that the domestic computer may soon become a reality. Industry and commerce will be able to draw data from central banks via a world-wide computer network, using satellite communication systems. ■

Computer usage is not restricted to office and factory. Here, a small computer is mounted on an experimental potato picking machine. The use of this computer is to control and evaluate the performance of the machinery. (Digital Equipment Company Ltd.)





ELECTRONIC CIRCUITS -IN THEORY and PRACTICE

TEACH-IN ...FOR BEGINNERS

By Mike Hughes M.A.

4

POWER

LAST month when we connected the 10 kilohm resistor in series with a 1mA meter, the reading in milliamps had the same numerical value as the voltage that was driving the current. Go back to using the single 10 kilohm in series with the meter and change the voltage of the battery to 4.5 volts. The current will be 0.45mA. Thus by changing the scale of the meter, we have a simple voltmeter which can measure up to 10 volts full scale. By putting two 10 kilohm resistors in series we have a voltmeter with a full scale reading of 20 volts. A two range voltmeter is shown in Fig. 1.

Make yourself a simple voltmeter using these principles. Initially it can be made up on the Demo Deck but if desired a separate meter could be bought and a separate instrument made.

A voltmeter of this type will usefully measure voltages in many electronic circuits but it suffers from a problem. This problem is that it has a resistance that in itself can "shunt" the circuit which is providing the voltage to be measured.

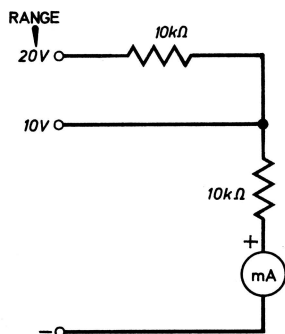


Fig. 1. A two range voltmeter. The numerical value of the current (in milliamps) gives the voltage value being measured.

This upsets the balance within the circuit and an erroneous voltage will be measured which will always read lower than actual. This means that the meter lacks sensitivity.

SENSITIVITY

The sensitivity of a meter is rated as the number of ohms the meter presents for every volt it measures. The unit we have just made is 1,000 ohms per volt and is fairly poor; more typically one requires a meter having a sensitivity of at least 10,000 ohms per volt. To make this we would have to use a basic movement having a sensitivity of 100 microamps (a microamp is one millionth of an ampere) and all our resistors would have to be scaled up in value by a factor of 10.

Test the effect of poor voltmeter sensitivity by connecting two 22 kilohm resistors in series across a 9V battery, and then use our 1,000 ohms per volt meter to measure the voltage between one end of the resistors and the common junction of the two (Fig. 2), then do the same with two 1 kilohm resistors. The reading should be 4.5V.

Justify in your own minds exactly what is happening and why the actual reading is less. The reason for this is that the 10 kilohm resistance of the meter has more shunting effect on the circuit using 22 kilohm resistors than with that using 1 kilohm resistors.

POTENTIAL DIVIDERS

The circuit of Fig. 2 is sometimes called a potential divider because the midpoint of two resistors has a potential which is based on the

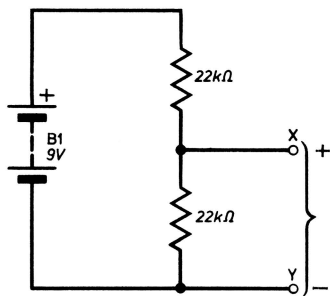


Fig. 2. Circuit for demonstrating voltmeter sensitivity.

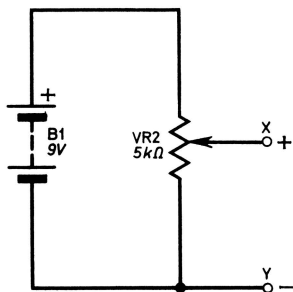


Fig. 3. The circuit diagram to be wired up on the Demo Deck to illustrate the function of a "potential divider."

potential difference across both resistors and the ratio of their values.

Substitute VR2 for the two resistors and use the wiper as the midpoint which can be varied in position to alter the ratio of the resistances either side of the wiper (Fig. 3). Measure the voltage between one end and the wiper as the knob is turned. You should get a smooth change from zero to 9V. Now try the same experiment with VR3 and VR4.

There is a great deal one can say about the principles of resistor networks, but in this beginners guide we have covered just sufficient to be of use later.

POWER

We are all familiar with the term POWER when applied to electricity. In any context it is the ability to do work whether it be manpower, horsepower or electrical power. In the latter case it is usually associated with the ability to heat something, light something or move something—the cone of a loudspeaker for example.

Driving voltage itself is not sufficient to do work—we must have current flow as well. Power is a function of both voltage and current and is measured in units of or fractions of a "watt".

Power measured in watts, $P = V \times I$ where V is the potential difference in volts and I is current flow in amperes. We can use this expression to calculate any one of the terms if the other two are known.

The current drawn by an electric fire of power 1.5 kilowatt (1.5kW) running from 250V mains

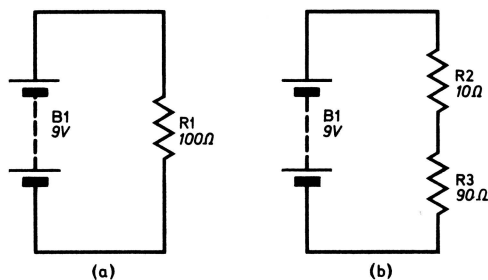


Fig. 4. The power dissipated in R1 is greater than in each of R2 and R3, but the total power dissipated in each circuit is identical.

will be given by

$$I = \frac{P}{V} = \frac{1500}{250} = 6 \text{ amperes}$$

Most frequently we are concerned with calculating the amount of power required by or dissipated in a circuit. The power dissipated in a resistor shows itself as heat, and is calculated from the current flowing through the resistance and the potential difference across it. The "potential drop" is equal to the value of the resistor multiplied by the current flowing through it (Ohm's Law)— $V = I \times R$. We can substitute $I \times R$ for V in the expression for power and obtain

$$P = I \times I \times R \text{ this is usually written } P = I^2 \times R$$

This means that we can calculate the power dissipated in any resistor purely from knowing the current flowing in the resistor and the ohmic value of the resistor.

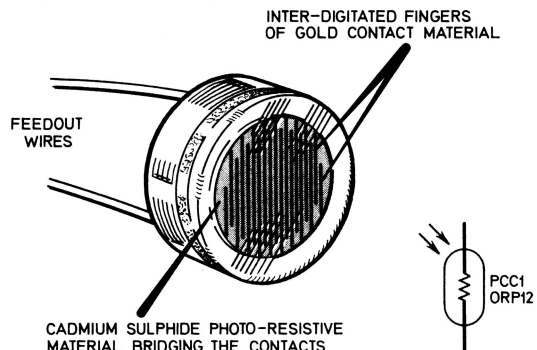
Look at Fig. 4a. We have a 100 ohm resistor connected across a 9V battery. What is the power dissipation in it? First of all calculate the current:

$$I = \frac{V}{R} = \frac{9}{100} = 0.09 \text{ ampere}$$

The power dissipated is therefore,
 $0.09 \times 0.09 \times 100 = 0.81 \text{ watt.}$

Resistor R1 would have to be capable of dis-

Fig. 5. The ORP12, a typical photo conductive cell, shown in diagrammatic form together with the circuit symbol and designation, PCC, for these devices.



sipating this amount of heat without undue rise in its temperature and the nearest commercially available type is a one watt device.

Fig. 4b shows two resistors in series across a 9 volt battery. Try calculating the dissipation in each resistor. First of all calculate the current flowing through the circuit as a whole then use this value of current in conjunction with the ohmic value of each of the resistors in turn. The answers are 0.08W for R2 and 0.73W for R3. Note that, although they are in the same circuit there is considerable difference in their respective dissipation. To prevent overheating the nearest commercial grades that we would use are $\frac{1}{8}$ and 1 watt devices respectively.

LIGHT DEPENDENT RESISTOR

Some electronic components have their maximum rating specified in terms of power as opposed to current. This is usual when overheating is likely to cause irreparable damage to the component. A typical example of this is the photo conductive cell or light dependent resistor. This is a very interesting and useful component because it enables us to make a whole range of simple but fascinating circuits that are actuated by light.

As its name implies it is a resistor whose ohmic value varies as light falls on it. The one we shall be talking about is readily available

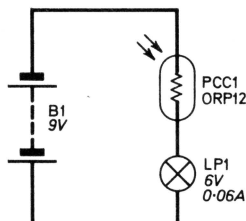


Fig. 6. (above) The circuit to demonstrate the action of a photocell. When bright light is incident on the cell, the lamp LP1 will light. **(below)** The wiring of this circuit on the Demo Deck.

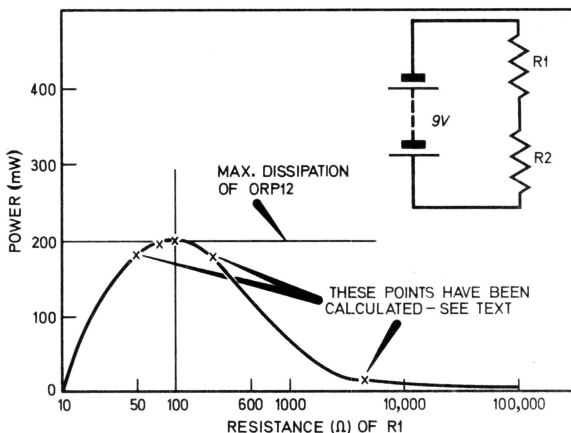
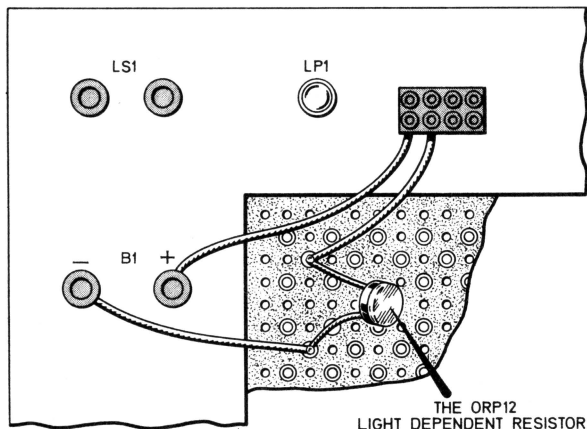


Fig. 7. Graph showing the power dissipation in R1 for various values of resistance with R2 held constant at 100 ohms. This is a maximum when $R1 = R2$.

and comparatively cheap—the ORP12. The appearance of the device is shown together with its symbol in Fig. 5; you can see that, like a resistor, there are two leads from it and the polarity of connection is not important.

There are several different types of this device (the ORP12 is perhaps the most common) but they can all be recognised by the distinctive interlocking fingers making contact with the photosensitive material—cadmium sulphide (CdS). Photographers will no doubt be familiar with the device because it is used as the sensor in CdS exposure meters.

The manufacturer of the ORP12 states that the resistance will typically vary from 10 Meg ohm in absolute dark conditions to approximately 75 ohm in conditions of extreme brightness. They also state that at no time may one dissipate more than 200mW in the device nor may one operate it with a potential difference greater than 110V across it.

EXPERIMENT

Use the Demo Deck to wire up the simple circuit of Fig. 6. Under normal room lighting conditions the resistance of the cell will be in excess of 500 ohm and this will prevent sufficient current to light the lamp. If you shine a very bright torch at the cell from close range you can make its resistance fall to approximately 75 ohm and the lamp will light up. You will probably be aware that the sensitivity of this circuit is poor because all the control is effected with extreme levels of light. This is because we are requiring the cell to pass quite a high current (60mA) to light the lamp and it is rather difficult to make its resistance fall sufficiently to do this.

Try working out the power dissipation in the photo cell for various light levels and see if we are exceeding the manufacturer's rating. The resistance of the photo cell varies typically from 5 kilohm down to 75 ohm for the range of lighting we are considering. Because the current

Table 1: REFERENCE DATA AND CHARACTERISTICS OF THE ORP12

Maximum power dissipation (ambient temp 25 degrees centigrade)	200mW
Absolute maximum cell voltage	110V
Cell resistance at 50 lux	2.4 kilohm
Sensitive area	0.6 cm ²
Typical resistance at 1000 lux with lamp colour temperature 2700 degrees Kelvin	75-300 ohm
Ultimate dark resistance at 110V	10 Megohm
Nominal rise time of resistance	75mS
Nominal fall time of resistance	350mS

through the cell will change as its resistance changes we cannot say that the power dissipation will be the same for every condition, in fact it is quite definitely *not* the same.

Try calculating the power dissipation in the photo cell when it has the following resistance values: 5 kilohm, 200 ohm, 100 ohm, 75 ohm and 50 ohm. To help you, assume that the bulb is simply a 100 ohm resistor.

You should find that when the photo cell resistance is 100 ohm the power dissipated is 202mW and at either side of this resistance value the dissipation is less. This is very important to appreciate because it tells us that the power dissipated is a maximum when the resistance of the cell equals the resistance of the load (the bulb). Strictly speaking, we are overstressing the capabilities of the photo cell by about 1 per cent when its resistance is exactly 100 ohm. In practice, however, this condition is unlikely to be maintained for any considerable period of time and besides, the dissipation limitation has a safety factor on its side and a momentary stress in excess of the rating can be permitted.

SPECIFICATIONS

Sooner or later one will need to refer to the manufacturer's specifications regarding components. Through this series we shall give you the most important specifications of the components we are using. The ORP12 is quite easily specified—see Table 1.

The parameter "Lux" is a measurement of light intensity; 50 lux is that equivalent to a dimly lit room while 1,000 lux is an exceptionally bright light—the intensity to be obtained a few inches away from a 100 watt bulb. The only parameter which you might not understand at this stage is the rise and fall time. These indicate that it takes a period of time for the cell to respond to changes in light level—the times shown for the ORP12 are quite long by electronic standards and are due to the fact that the reaction within the cell is almost a photochemical effect. Some other types of photoelectric devices can respond to millions of changes of light per second!

EXPOSURE METER EXPERIMENT

We have already said that the light dependent resistor is used in cadmium sulphide exposure

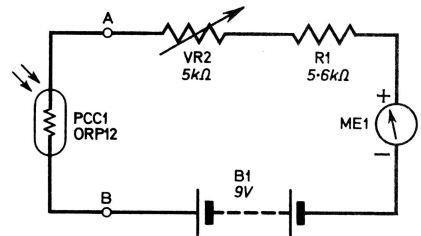
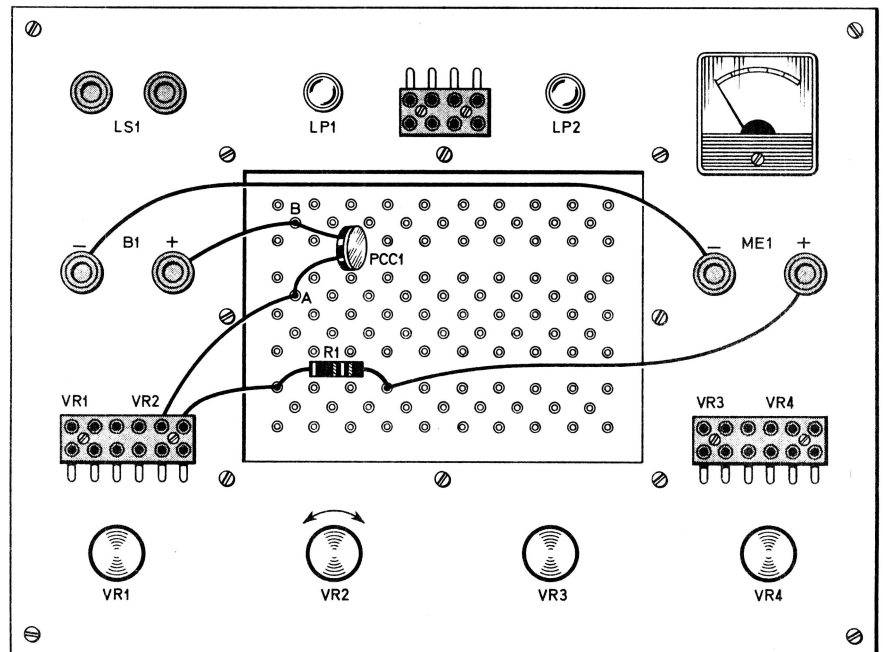
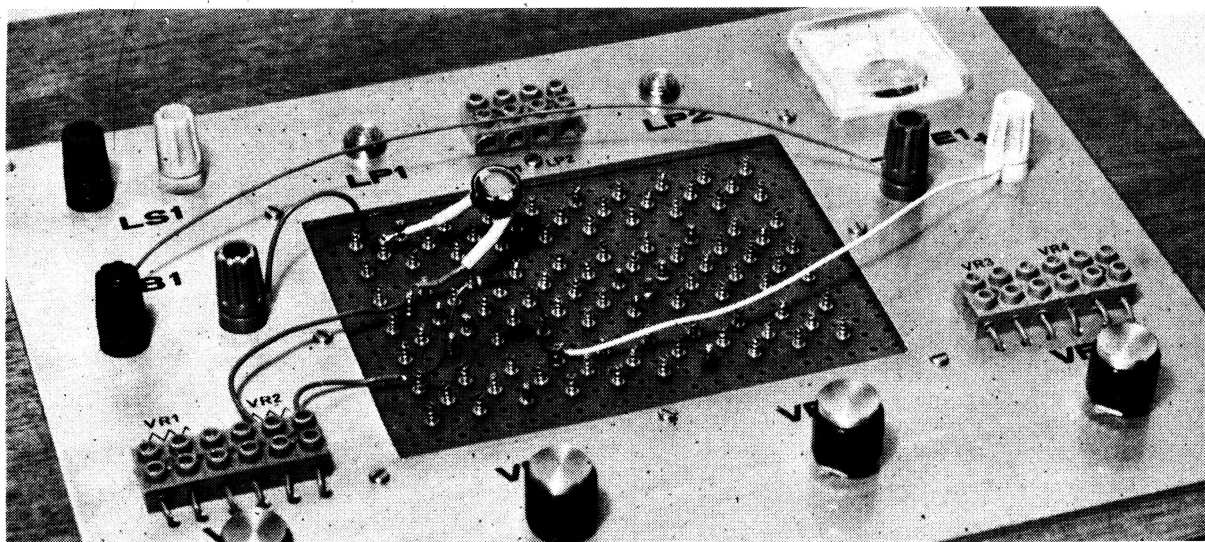


Fig. 8. (above right) The circuit diagram for a simple ohm meter which can be calibrated for use as an exposure meter. (right) This circuit wired up on the Demo Deck.





meters so now we will use the Demo Deck to make a simple version of this. Fig. 8 shows the circuit. It is a simple ohm meter where the ORP12 is a resistor whose ohmic value we shall be constantly observing.

It is usual with ohm meters to have zero ohm reading full scale on the meter. We are using a 1 mA (f.s.d.) meter, so must arrange that when we short circuit the input to the meter (across points A and B) exactly 1 mA is permitted to flow. As we are using a 9 volt battery we must incorporate a limiting resistor.

This is calculated using Ohm's Law,

$$\text{i.e. } R = \frac{V}{I} = \frac{9}{0.001} \text{ ohm} \\ = 9 \text{ kilohm}$$

Because the battery voltage will vary a little with time we must make this resistor variable so that we can always set a zero ohm reading of full scale.

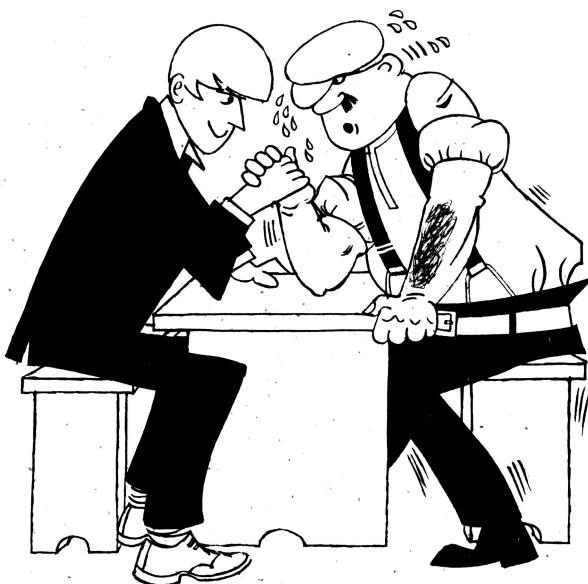
We could use a 10 kilohm potentiometer to do this but there is a danger that while adjusting it one might inadvertently reduce the resistance value to zero and pass excessive current through the sensitive meter. To prevent this happening we shall use a fixed resistor of 5.6 kilohm in series with VR2 (5 kilohm) on the Demo Deck. The combined effect of these two resistors will give us a variable range from 5.6 to 10.6 kilohm—ample to allow for battery variations but at the same time it will be impossible to pass more than about 2 mA through the meter (this would not cause any serious damage to the meter). With new batteries we should get our full scale zero ohms reading with VR2 set to almost maximum resistance.

METHOD

When set for zero ohm at full scale, disconnect the short circuit between points A and B and allow the ORP12 to come into circuit. We are now introducing extra resistance, thus the

current through the meter will fall. If a lot of light is falling on the cell its resistance will be low (say 100 ohm) and this will have very little effect on the total circuit resistance, hence the meter will still read fairly high up the scale. If you prevent light falling on the cell, its resistance increases rapidly and the current displayed on the meter falls dramatically. Different levels of light between these extremes will give graded readings on the meter. For a given film speed one could carry out some trial exposures and experimentally produce a scale (or graph) which will convert the meter current reading into photographic light value numbers.

Next month : Capacitors



rain warning ALARM

By
Frank Brown

Protect the washing from
rain, snow and damp with
this simple device.

THE device to be described will provide an alert when rain or snow is falling or when the atmosphere is saturated as when steam or mist is forming. It can serve as a water level alarm with no modifications to the sensor input and, as it is sufficiently sensitive to detect a human breath at a foot range, it could find use as a novelty item at parties.

Two alarm circuits are offered; an audio tone generator pitched at 2.5kHz and a lamp flasher. While a tone is to be preferred for remote hailing a flashing lamp would be preferable to a person hard of hearing or if the device is used in a party role.

COMPOUND PAIR

The transistors TR1 and TR2 in Fig. 1. are so arranged to very much magnify any small current that might appear at the base/emitter junction of TR1. This compound pair configuration is a cheap way of making up what is, in effect, a very high gain transistor with an amplification factor that approximates to the product of the individual transistor gains.

The small current to be amplified is produced whenever snow, rain or moisture bridges the copper strips of a 0.1 in. matrix veroboard sensor which appears in the input circuit.

These strips are so connected (Fig. 2.) as to make the whole board area moisture sensitive.

The load of the compound pair is the alarm circuit comprising TR3 and TR4. Since the smallest of input currents to TR1 is capable of switching TR2 hard on, this means that nearly

all of the line volts will appear at the junction of the collectors of the compound pair.

AUDIO ALARM

The audio alarm circuit consists of a *pn*p/*np*n free running multivibrator designed to produce a penetrating tone without recourse to a transformer.

The Fletcher-Munson curves of equal loudness show that the human ear is most sensitive to sounds between 2kHz and 4kHz. Using the components specified, the alarm will produce a note of approximately 2.5kHz and, although the power output from the alarm is relatively small the note produced is quite piercing.

With moisture completing the input circuit and TR2 switched on, C1 charges by way of R2, R3 and LS1 until the voltage it acquires is sufficient to switch on TR3 which, in turn, switches on TR4. The collector of TR4 is thus taken to a negative potential. The switching process is hastened by feedback through C1 so that TR4 is very rapidly bottomed.

This change cannot immediately be followed

Approximate cost of components

£

1.80 excluding case

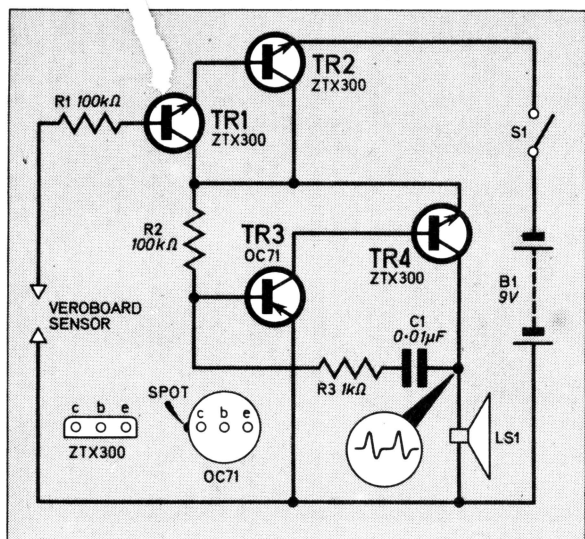


Fig. 1. Circuit diagram of the rain warning alarm.

by C1 which discharges via R3 and TR3 base/emitter. Having R3 in circuit increases the discharge time constant and therefore, the mean d.c. level to the loudspeaker which, of course, means a greater sound output.

With the discharge of C1 both TR3 and TR4 are cut off and the oscillator recycles. The frequency at which the transistors are turned on and off and therefore the frequency of the tone generated depends on the value of C1 and the resistance of its charge path; an increase in either means a decrease in frequency and vice-versa. The output waveform appearing across LS1 is shown in Fig. 1.

If at any time after the unit is built greater sound output is required a 0.47μF capacitor connected across the loudspeaker will prove a simple expedient rather than experimenting with different values for R3. It must be realised that any increase in output will mean a heavier current drain. With the components given, consumption with the oscillator functioning worked out at around 15mA.

LAMP FLASHER

Since this type of multivibrator circuit provides periodic short bursts of power (see output waveform) to a load it is ideal for flashing a lamp.

To change the alarm circuit of Fig. 1. for lamp operation means the change of only three components. A 6V 0.06A lamp replaces LS1, and R2 and C1 are changed to 470 kilohms, and 2.2μF respectively. If an electrolytic is used for C1, the positive side must be connected to the collector of TR4.

For the timing components given above the flash rate is about two flashes every second.

Everyday Electronics, February 1972

Since the flash interval is very brief battery power taken is small compared to the audio alarm.

CONSTRUCTION

The majority of components are mounted on a 2½ inch x 1 inch, 0.15 inch matrix piece of

Components....

Resistors

R1 100kΩ (or 500kΩ lin. potentiometer—see text)

R2 100kΩ

R3 1kΩ

All ½ watt ±10% carbon

Capacitor

C1 0.01μF

Transistors

TR1, TR2, TR4 ZTX 300 silicon npn (3 off)

TR3 OC71 germanium pnp

Loudspeaker

LS1 8Ω 2in diameter (or similar small speaker—see text)

Switch

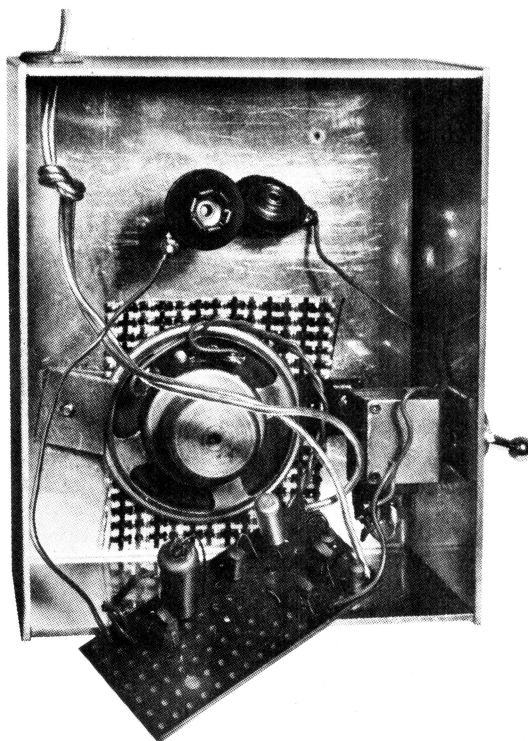
S1 Single pole on/off toggle

Miscellaneous

B1 PP9 battery, 5in x 4in x 2½in aluminium chassis, Veroboard 16 holes x 7 strips 0.15 matrix (see text), 4in x 3in x 0.1in matrix (for sensor), wire, 4 BA fixings.

**Shop Talk
refers**

Prototype construction of the Rain Warning Alarm.



ALARM

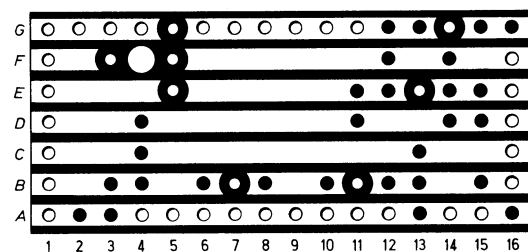
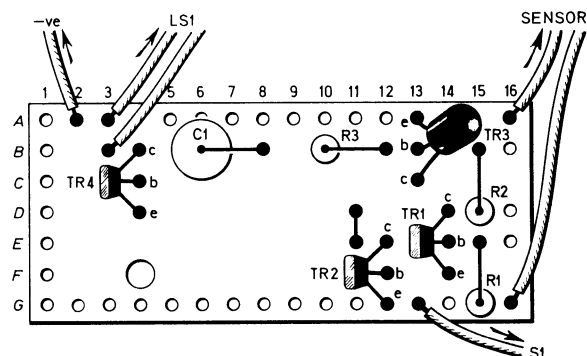
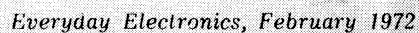
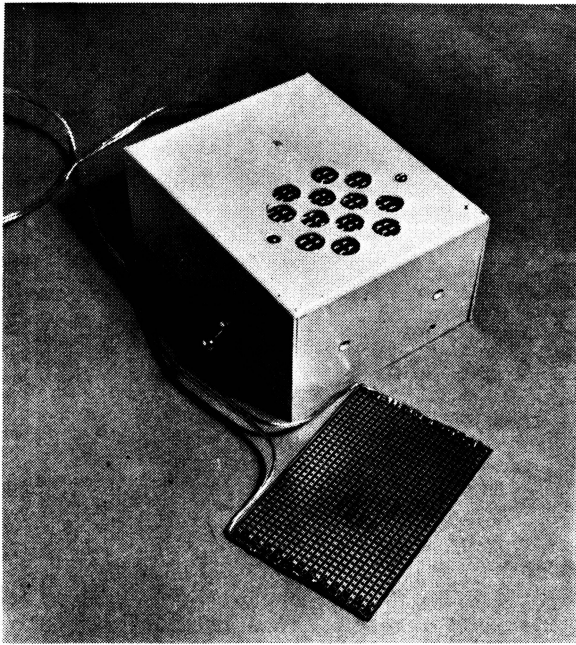


Fig. 4. (below) Layout and wiring of all parts mounted in the case.





The completed unit with the sensor

Veroboard (the same size as that given away with the first issue), with the speaker and switch arranged on a small aluminium case.

The circuit performance will not suffer from alternative forms of layout so tag-strip or Cir-kit can be used.

The Veroboard layout and wiring diagram is shown in Fig. 3. The size of the piece of board used could be reduced slightly if a very compact unit is required, however since the battery used should be fairly large for a long life, reduction in size of the Veroboard was not considered advantageous. Construct the board as shown in Fig. 3 taking care when soldering the transistors not to overheat them. This particularly applies to the OC71 which is a germanium device and which should be soldered in, using a heat shunt, after all other components and leads have been attached.

After checking the board for mistakes, mount it in the case and connect up S1, LS1 B1 and the sensor (Fig. 4). Finally check the circuit and the battery polarity and switch on. A quick operational check can be made by touching the copper strips on the sensor with one finger, the unit should immediately give the warning signal. Test the sensitivity of the alarm by blowing on the sensor.

If required a small two-way socket may be included in the lead to the sensor (which is not polarity conscious) so that the sensor could be disconnected from the unit for installation.

When making up the Veroboard sensor simply solder on two lengths of wire at either end of a 4 inch x 3 inch piece of 0.1 inch matrix Vero-

board so that the wire bridges all the copper tracks. Then, with a spot-face cutter or twist drill, make breaks on either side to alternate tracks as in Fig. 2. If high sensitivity is not required the size of the piece of Veroboard used may be reduced. The 0.1 inch matrix board is however most suitable.

If other values of loudspeaker are to hand, such as 3 or 15 ohm types, these can be used but it will mean experimenting with the value of C1 since substitution will produce frequency change.

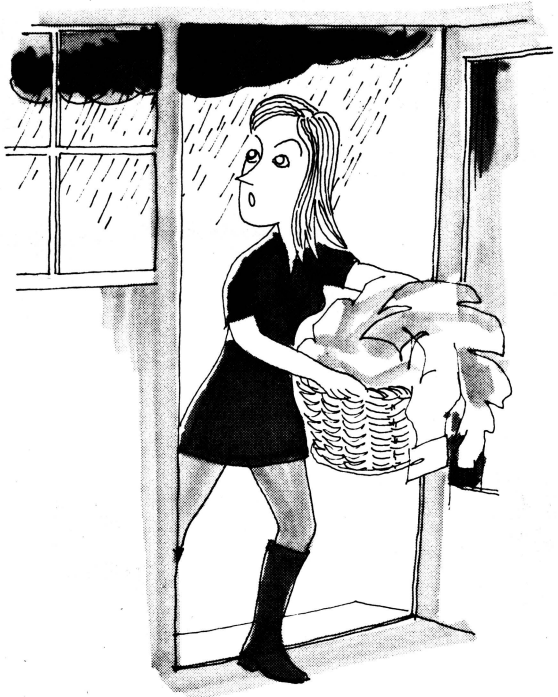
APPLICATIONS

When siting the sensor the only requirement is that it should be placed on a flat surface. The length of lead to the sensor will not affect circuit performance.

If a 500 kilohm potentiometer is substituted for R1 the input sensitivity can be made variable. Since the base/emitter breakdown voltage of the ZTX 300 is 5V there is no danger of transistor destruction for the condition of maximum sensitivity with little resistance in the input line.

For use as a water level alarm the sensor should be arranged vertically with the lower two tracks at the required height. Obviously, rising water bridging these tracks will trigger the alarm.

As a novelty item the Veroboard could be attached to the top of the aluminium chassis. For this the lamp flasher circuit is used so that anyone breathing or blowing on the sensor literally blows the lamp on. □



USING STICK DOWN WIRING

The Waa Waa Pedal featured in this issue utilises stick down wiring ; this article describes how to use it.

THE series of photographs below show how to use stick down wiring; photographs (a) to (e) show the *Waa Waa Pedal* being built.

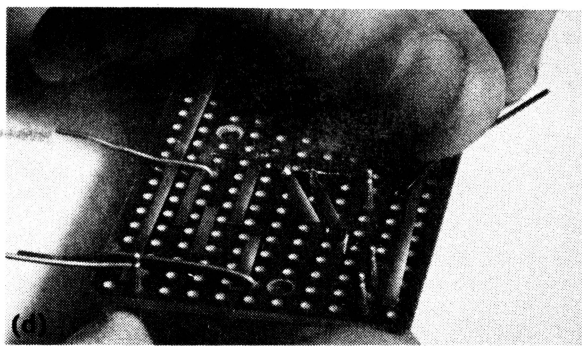
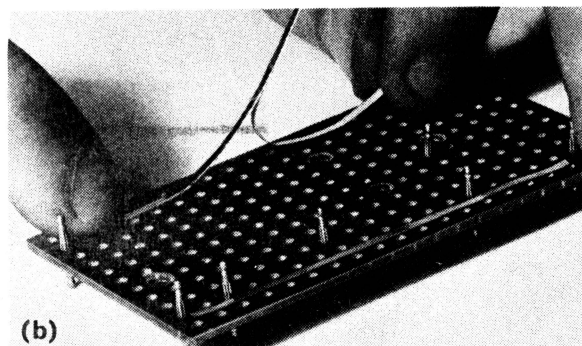
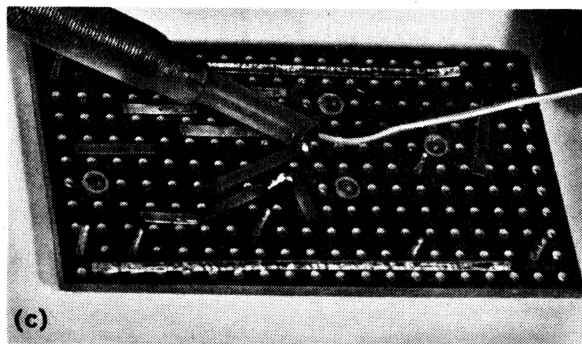
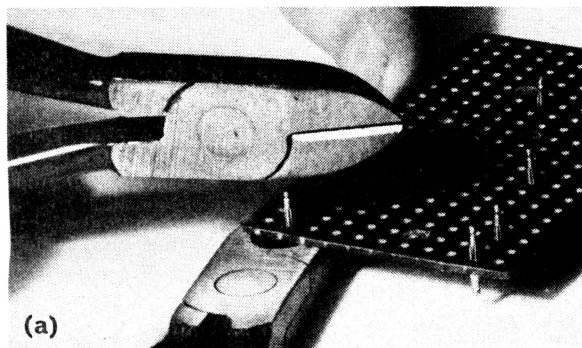
Stick down wiring or Cir-kit, to use its trade name, is available in two sizes $\frac{1}{16}$ and $\frac{1}{8}$ inch width, and can be used with either plain or perforated, mounting panels. The *Waa Waa Pedal* unit described in this issue utilises $\frac{1}{16}$ inch width Cir-kit with a perforated s.r.b.p. panel. The Cir-kit forms the connections in the same way that the copper on Veroboard or a printed circuit form connections for the components.

LAYING THE CIRCUIT

To use stick down wiring first design a component layout or use that provided in the article (Fig. 3 in *Waa Waa Pedal*), cut the circuit board to size using a hacksaw, drill any mounting holes

and de-burr the board. The *Waa Waa Pedal* design utilises Veroboard pins for the connection of flying leads and this practice is to be recommended when using Cir-kit. The pins provide firm anchorage points for the leads and hence no strain is put on the copper strips. The pins should be inserted by supporting the board under the pin and tapping the pin in gently until it is half-way through the board (a). Mark the position of each copper strip on the board using a felt tip pen. Once all the pins have been inserted and checked the Cir-kit can be laid.

Lay the copper strip along the first section marked and cut the strip to the required length for this section. Check the length and position and carefully peel off part of the white backing strip, taking care not to touch the self adhesive back. Position the strip, peel off the remaining



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B99	200	Mixed Capacitors. Approx. quantity, counted by weight	50p
H4	250	Mixed Resistors. Approx. quantity counted by weight	50p
H7	40	Wirewound Resistors. Mixed types and values.	50p
H8	4	BY127 Sil. Recs. 1000 PIV. 1 amp. plastic	50p
H9	2	OC71 Light Sensitive Photo Transistor	50p
H12	50	NKT155/259 Germ. diodes, brand new stock clearance	50p
H18	10	OC71/75 uncoated black glass type PNP Germ.	50p
H19	10	OC81/81D uncoated white glass type PNP Germ.	50p
H28	20	OC200/1/2/3 PNP Silicon uncoated TO-5 can	50p
H29	20	OA47 gold bonded diodes coated MCS2	50p

NEW UNMARKED UNTESTED PAKS

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B83	200	Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ.	50p
B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202	50p
B86	50	Sil. Diodes sub. min. IN914 and IN916 types	50p
B88	50	Sil. Trans. NPN, PNP equiv. to OC200/1/2N706A, BSY95A, etc.	50p
B1	50	Germanium Transistors PNP, AF and RF	50p
H6	40	250mW. Zener Diodes DO-7 Min. Glass Type	50p
H10	25	Mixed volts, 1 1/2 watt Zeners Top hat type	50p
H17	20	3 amp. Silicon Stud Rectifiers, mixed volts	50p
H15	30	Top Hat Silicon Rectifiers, 750mA, Mixed volts	50p
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AC176	0-25	2G301	0-13
AC177	0-15	2G303	0-13
AF239	0-37	2N711	0-50
AF186	0-50	2N1302-3	0-20
AF139	0-37	2N1304-5	0-25
BC154	0-25	2N1306-7	0-30
BC107	0-13	2N1308-9	0-35
BC108	0-13	2N3819FET	0-45
BC109	0-14		
BF194	0-13		
BF274	0-15		
BFY50	0-20		
BSY25	0-57		
BSY26	0-13		
BSY27	0-13		
BSY28	0-13		
BSY29	0-13		
BSY95A	0-15		
OC41	0-13		
OC44	0-13		
OC45	0-13		
OC71	0-13		
OC72	0-13		
OC81	0-13		
OC81D	0-13		
OC83	0-20		
OC139	0-13		
OC140	0-17		

F.E.T. PRICE

BREAKTHROUGH!!

This field effect transistor is the 2N3823 in a plastic encapsulation, coded as 3823E. It is also an excellent replacement for the 2N3819. Data sheet supplied with device. 1-10 30p each, 10-50 25p each, 50+20p each.



BULK BUYING CORNER

NPN/PNP Silicon Planar Transistors, mixed, untested, similar to 2N706/6A/8, BSY26-29, BSY95A, BCY70, etc. £4-25 per 500; £8 per 1,000.

Silicon Planar NPN Plastic Transistors, untested, similar to 2N3707-11, etc., £4-25 per 500; £8 per 1,000.

Silicon Planar Diodes, DO-7 Glass, similar to OA200/202, BAY31-36, £4-50 per 1,000.

NPN/PNP Silicon Planar Transistors, Plastic TO-18, similar to BC113/4, BC153/4, BF153/160, etc., £4-25 per 500; £8 per 1,000.

OC44, OC55 Transistors fully marked and tested, 500+ at 8p each; 1,000+ at 6p each.

OC71 Transistors, fully marked and tested, 500+ at 6p each; 1,000+ at 5p each.

3823E Field effect Transistors. This is the 2N3823 in Plastic Case, 500+ 13p each; 1,000+ 10p each.

1 amp Miniature Plastic Diodes:

IN4001, 500+ at 4p each; 1,000+ at 3p each.
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OC71 or 72 Fully Tested Unmarked		5p	5p 4p
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OA47 Gold-Bonded Diodes, Marked and Tested		3p	3p 2p
1-watt Zener Diodes 7-5, 24, 27, 30, 36, 43 Volts		5p	4p 3p
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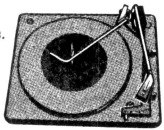
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32/450V <td>20p</td> <td>8/450V <td>18p</td> <td>16/32/450V</td> <td>33p</td> </td>	20p	8/450V <td>18p</td> <td>16/32/450V</td> <td>33p</td>	18p	16/32/450V	33p
25/25V <td>10p</td> <td>8/16/450V <td>20p</td> <td>350/50/325V</td> <td>60p</td> </td>	10p	8/16/450V <td>20p</td> <td>350/50/325V</td> <td>60p</td>	20p	350/50/325V	60p
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Everyday Electronics, February 1972

MEMORY STORE

Retrieval By

Dick Railton

ELECTRONICS today offers reward in so many different areas of our lives that it is difficult to remember clearly those times when it hardly existed at all, and then only in the form of the mysterious "wireless". Perhaps it became my hobby because of the thrill experienced the first time I heard an identifiable voice in a pair of uncomfortable headphones attached to my very own "crystal set".

The greatest single item then in favour of wireless was that a boy, with the aid of normal workshop tools, a lump of the magic crystal, tuning condenser (now called a capacitor) and headphones, could achieve results equal to the best minds of the century—almost

anyway. Thus the sense of power which could grow from this may well be the key, though I think not.

To me, my hobby went hand-in-hand with Wells, Huxley and Willy Von Braun, long before Peenmunde, Flash Gordon and the slowly growing ranks of Science Fiction writers. Our faith in journeys through space to conquer the Universe could only be supportive of and by our hobby. It may be easy to say, but hindsight has shown the dreams of youth to be true. After all, it is not a question now of "Is there life elsewhere in the Universe?", it is more a case of where and how much.

The war itself gave tremendous impetus to the growing electronics industry and, via the Government surplus stores, the hobby benefited accordingly. Here, in fact, electronics began to emerge as something applicable outside mere wireless. Slowly it produced applications in medi-

cine, industry, the cinema, the theatre and the home. Examples abound.

The most successful valve amplifier ever is undoubtedly the Williamson, designed by the man of the same name—an amateur/professional. The equipment was largely amateur-proved before commercial adoption. The same can be said of the Dinsdale solid-state equipment and the Lindsay-Hood class A equipment. All these are audio equipments and represent only a tiny part of electronics as a hobby. You can't ask much more of any hobby than that it allows you to be amongst the first to do something and that at the same time you enjoy the doing.

The person coming to electronics for the first time nowadays has far more scope in real terms than was available years ago. Thus it seems difficult to me to see how anyone cannot be interested.

ABBREVIATIONS

The following is a list of abbreviations used in the text of articles and in components lists. Only the direct meaning of the abbreviations is given, no attempt has been made to describe the meaning of the words in full. For further information and full descriptions readers should follow the Teach-In series.

a.c.	alternating current
a.f.	audio frequency
a.f.c.	automatic frequency control
a.g.c.	automatic gain control
a.m.	amplitude modulation
BA	British Association (nut and bolt sizes)
cm	centimetre
d.c.	direct current
d.p.d.t.	double-pole double-throw
elect.	electrolytic
e.h.t.	extra high tension
e.m.f.	electromotive force
f.e.t.	field effect transistor
f.s.d.	full scale deflection
f.m.	frequency modulation
ft.	feet
g.	gram
h.t.	high tension
i.c.	integrated circuit
in.	inch
l.d.r.	light dependent resistor
lin.	linear
log.	logarithmic

l.t.	low tension
m	metre (measurement of length)
mm	millimetre
m.w.	medium wave
npn	transistor structure (two types)
pnp	
oz	ounces (avoirdupois)
p.i.v.	peak inverse voltage
p.v.c.	polyvinyl chloride
r.f.	radio frequency
r.m.s.	root mean square
s.p.s.t.	single-pole single-throw
s.r.b.p.	synthetic resin bonded paper
s.w.g.	standard wire gauge
t.r.f.	tuned radio frequency
u.h.f.	ultra high frequency
u.j.t.	unijunction transistor
v.h.f.	very high frequency
%	per cent
A	ampere (amp)
dB	decibel
F	Farad
H	Henry
Hz	Hertz (cycles per second)
Ω	ohm
V	volt
W	watt
p	pico (÷ 1,000,000,000,000)
μ	micro (÷ 1,000,000)
m	milli (÷ 1,000)
k	kilo (× 1,000)
M	Mega (× 1,000,000)



ONE or two readers have made enquiries as to substitute components that can be used in our circuits. There are some points concerning substitutes that will probably be useful: first resistors. In general we use ± 10 per cent, $\frac{1}{4}$ watt carbon types; ± 10 per cent is now a more common tolerance than ± 20 per cent and this is often the reason for quoting the lower figure. If you wish to use ± 5 per cent (or better) types by all means do so. A similar point can be made with wattages, $\frac{1}{4}$ watt types are common but you can use $\frac{1}{2}$ watt, 1 watt or even larger types provided they will fit on the component board. Never use a lower wattage type than that specified.

Capacitors

Capacitors are more difficult to lay down rules about, electrolytic types often have tolerances of -10 per cent to $+100$ per cent or -10 per cent to $+50$ per cent so you can see that substitution by a similar value to that which we quote should not unduly affect the circuit e.g. for a $25\mu\text{F}$ capacitor having a -10 per cent to $+50$ per cent tolerance its value could be anything between $22.5\mu\text{F}$ and $37.5\mu\text{F}$ so you could probably use values between $20\mu\text{F}$ and $40\mu\text{F}$ without seriously affecting operation of the circuit. Voltage of electrolytics is more important and you should not use types having a lower voltage rating than that given—higher ratings may be used but it is a good idea to stay within four

times the specified voltage e.g. for a 12V electrolytic you could use capacitors having working voltages from 12V to about 50V.

With most other types of capacitor we do not state a tolerance or working voltage and often no specific type. In these cases the general rule is buy the cheapest available and do not worry about working voltage unless we state it. Incidentally condenser is the old term for capacitor—motor mechanics and some “behind the times” firms still use condenser, don’t be put off by it.

Auto Alert

The G.P.O. type relays used in the *Auto Alert* may be expensive if new ones are purchased, there are plenty of shops selling second hand ones in good condition for about 50p and this could save as much as £2 when buying both. It is important that each relay only has one set of normally closed contacts, if the one you buy has more, undo the mounting screws and remove the unwanted contacts. You must make sure that the coils on the relays are 2000 ohms, there are other values.

If a dash mounted push button is used remember that it must be a push to changeover and release to restore type; there are various types available from the larger suppliers. The micro-switch used with the foot pedal is of a similar operational type—this is standard for most micro-switches so buy a cheap one, the current rating is not important.

Radio Control Monitor

“Powerless”, pocketable and very useful, the *Radio Control Monitor* is also easy to build. Variable capacitors may vary slightly (sorry about that) but most types will be satisfactory. Any trouble with the tube can be overcome by a good look at all the catalogues you bought.

It is possible to make up the tube with paper and varnish, wrapped around suitable formers but it may be a bit messy.

Rain Warning Alarm

The loudspeaker used in the *Rain Warning Alarm* is not critical either in size or impedance. The 8 ohm impedance, 2 inch diameter speaker specified could be slightly increased in size and still fit inside the case described. However,

as stated in the text, any small 3 to 15 ohm speaker could be used if these are more easy to obtain. The power rating of this speaker should be between 50mW and 1W.

As stated in the text the Vero-board sensor should be made from 0.1 inch matrix. If you have some 0.15 inch matrix board to hand, this could be used but the sensitivity of the alarm will suffer.

Waa Waa Pedal

The inductor will probably be the most difficult part to obtain for the *Waa Waa Pedal*. The Ferro-cube pot core is available from some of the larger suppliers and may also be in local shops. If you buy this you will have to take it apart (quite a simple process) and wind the 500 odd turns on the bobbin inside. Although this takes some time it is a simple process. However, we have seen some inductors of about 10 millihenries (8-12 mH will suffice) advertised in the catalogues. These are wound on ferro cores similar to that specified and they are probably cheaper than buying the cube and the wire and winding your own.

Meccano parts for the gears and pedal linkage are available from most toy and model shops.

Cir-Kit, the stick down wiring, that is used on the *Waa Waa* component board is available from most of the component shops. The $\frac{1}{16}$ inch wide type should be used as this fits between the holes on the perforated board.

New Products

Very little new products information has found its way into the office this month, in fact the only worthwhile new product for amateurs is a 12V 35W soldering iron shown below with its bayonet fitting metal transit cover.



The iron is fitted with 12ft of lead and 25 amp battery clips to enable easy connection to a car battery. Just the job for soldering in the car projects that we give designs for, such as the *Auto Alert* in this issue. The heat shroud enables the iron to be packed away immediately after use. Manufactured by Solderstat Limited the “Motorist Pack” costs £2.87.

28watts, r.m.s. 40Hz to 40kHz $\pm 3\text{dB}$



Viscount III Audio Suite complete £49

There are two stereo amplifiers—the R100 for ceramic cartridges, the R101 for magnetic and ceramic. Both incorporate FETs (FIELD EFFECT TRANSISTORS), just like top-priced units. FETs give you more of the signal you want, and almost none of the background hiss you don't. Both units have a jack socket to plug in headphones and there's a separate output for tape recorder. Filters (an unusual feature in this price range) and tone controls give a wide range of bass and treble adjustment which compensates for input deficiencies and domestic acoustic conditions.

PRICES SYSTEM 1

Viscount III R101 amplifier £22.00 + 90p p&p
2 x Duo Type II speakers, £14.00 + £2 p&p
Garrard SP25 Mk. III with MAG.
cartridge plinth and cover £23.00 + £1.50

Total £59.00 p&p

Available complete for only £52.00 + £3.50 p&p

SYSTEM 2

Viscount R101 amplifier £22.00 + 90p p&p
2 x Duo Type III speakers £32.00 + £3 p&p
Garrard SP25 Mk. III with MAG.
cartridge, plinth and cover £23.00 + £1.50

Total £77.00 p&p

Available complete for £69 + £4 p&p

SYSTEM 3

Viscount III Amplifier R100 £17.00 + 90p p&p
2 x Duo Type II speakers, pair £14.00 + £2 p&p
Garrard SP25 Mk. III with CER. diamond
cartridge, plinth and cover £21.00 + £1.50

Total £52.00 p&p

Available complete for only £49.00 + £3.50 p&p

SPEAKERS Duo Type II

Size approx 17" x 10½" x 6½". Drive unit 13" x 8" with parasitic tweeter. Max. power 10 watts. 3 ohms. Simulated Teak cabinet.

£14 pair + £2 p&p.

Duo Type III Size approx 23½" x 11½" x 9½". Drive unit 13½" x 8½" with H.F. speaker. Max. power 20 watts at 3 ohms. Freq. range 20Hz to 20kHz. Teak veneer cabinet. £32 pair + £3 p&p.

SPECIFICATION R101

14 watts per channel into 3 to 4 ohms. Total distortion @ 10W @ 1kHz 0.1%. P.U.1 (for ceramic cartridges) 150mV into 3 Meg. P.U.2 (for magnetic cartridges) 4mV @ 1kHz into 47K. equalised within $\pm 1\text{dB}$ R.I.A.A. Radio 150mV into 220K. (Sensitivities given at full power). Tape out facilities; headphone socket, power out 250mW per channel. Tone controls and filter characteristics. Bass: +12dB to -17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to -12dB @ 15kHz. Treble filter: 12dB per octave. Signal to noise ratio: (all controls at max) R101—P.U.1 and radio—65dB. P.U.2. —58dB. R100 same as R101 but P.U.2 (for crystal cartridges) 450mV into 3 Meg. Cross talk better than -35dB on all inputs. Overload characteristics better than 26dB on all inputs. Size approx 13½" x 9" x 3½".

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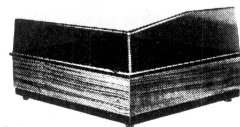
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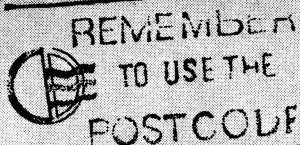
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Readers Letters

Projects

Congratulations (if not too late) on your new magazine *EVERYDAY ELECTRONICS*. I never thought this magazine would interest the "whole family" and now we look forward to the next edition to arrive.

My reason for writing is to ask if you intend to print in future editions any projects like intercoms? My three children are always asking me to install an intercom unit in their three bedrooms. Will this be a future project? If not would you be so kind as to advise me where to obtain the necessary diagrams etc.

Peter Pleydell
Coventry.

I am writing to you on behalf of my colleagues and myself to ask if you have any circuit diagrams concerning high power amplifiers suitable for electric guitars. I would be most grateful if you could send me a circuit diagram for an amplifier of about 100 watts. I have made the *Fuzz Box* you described in issue 2 of *EVERYDAY ELECTRONICS*. I found it most enjoyable and interesting to make and results were very pleasing.

I think that many people would enjoy making a treasure locator and I suggest that this would be a very interesting constructional project for a future edition.

Philip Crossland,
Derek White
Yorkshire.

Unfortunately we cannot supply circuit diagrams or designs other than those published. The 100 watt amplifier is rather too complicated to form an E.E. project. However the other suggestions—the intercom and treasure locator will almost certainly be dealt with in future issues.

Binders

May I make a suggestion? Offer self binders indexed volume by volume attractively produced and gold titled to grace a modern library shelf to hold your issues as they appear and keep them in good clean reference order.

Everyday Electronics, February 1972

Price today? Haven't a clue; perhaps £1.25 to £1.50 each, the cheaper the selling price that can be maintained, the better.

L. F. Tearry
Kent.

We have already thought of making binders available and when we know what they will look like and how much they will cost, we will publish a notice giving full details—so watch the next few issues.

Clear Fuzz

First, congratulations to you and your staff on a first class magazine. I am so pleased with it that I shall soon be placing a subscription order to ensure that I don't miss an issue.

Secondly, with reference to your *Fuzz Box* project; I am a keen follower of any electronic music developments so I decided to build this project for experimentation purposes. I have never used Veroboard before, but I have managed to get the entire circuit onto the piece provided in the No. 1 edition. An even bigger surprise was the fact that it worked first time. In fact this is the first time this has ever happened to a project I have built.

The unit is now in use by a professional pop group, one of who is a friend of mine, and has proved exceptionally reliable even under overload. As suggested I included the bypass footswitch to switch the effect in and out.

I, however, take none of the credit for this as it is due to you for a well laid out, easy-to-understand way of going about the various projects.

C. A. Bradberry
West Dulwich.

Although you are well satisfied with your *Fuzz Box* some readers have had problems. With the circuit as published there is a danger of damaging transistor TR2. To avoid this a 10 kilohm resistor should be placed between the potentiometer VR1 and the positive line. Also, if a footswitch is fitted, the unit should be made to turn off when the input and output are shorted together.

Reversed Sentinel

May I take this opportunity to tell you that I look like being an ardent fan of *EVERYDAY ELECTRONICS*, for a long time to come. Having had, for a long time, the urge to "have a go" at something in the electronics field, but always being beaten due to the lack of knowledge on the subject, I was delighted when your magazine came out. It looked at last as if even I was going to be able to tackle something with some hope of success, and after the clear concise way you are presenting the projects, I had every confidence this would be the case.

But alas, no. I have just completed the *Home Sentinel* and let me say right away—but the wrong way round.

With light falling on the cell face the relay is pulled in, when the light is interrupted, the relay clicks out. Following the instructions in the article, with light on the cell face, I backed off the variable resistor until the relay clicked out, but when the light is cut off to the cell, the relay will not pull in, and no amount of adjustment will make it function as it was intended to. I must say, even in its present state, I am highly delighted to think I have been able to make it, and to have it function at all.

Could you please suggest what could have gone wrong with it. I am afraid that if it will involve the use of test equipment, I will have to be content with it.

A suggestion I would like to make, that I am sure a lot of other readers in the same position as myself will endorse, would be the inclusion in the magazine of a readers "Questions and Answers" section. In this way, someone always asks the question that has been bugging everyone else, and then they all have the answer.

Another suggestion is that once a month is too long to wait for the next issue, please let us have an issue once a week, or at worst, once a fortnight.

If you could spare the time to answer my query, I would be extremely grateful.

D. Hill
Leeds.

The contacts on your relay are obviously normally open types—the use of normally closed contacts would solve the problem. If the relay you have does not have normally closed contacts then reverse the positions of PCC1 and R1 and all will be well.

Once a month may well be too long for some readers but we often find it too short a period in the editorial offices—one reason why some readers are still waiting for replies to their letters.

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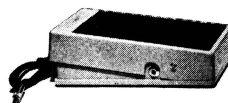
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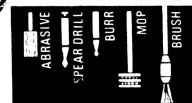
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100μA.....	\$3.45	50V. D.C.....	\$3.10
500μA.....	\$3.20	300V. D.C.....	\$3.10
100-0-100μA	\$3.45	1 amp. D.C.....	\$3.10
500μA.....	\$3.35	5 amp. D.C.....	\$3.10
1mA.....	\$3.10	300V. A.C.....	\$3.10
		VU Meter.....	\$3.75

BAKELITE PANEL METERS

TYPE S-80
80 mm. square fronts

50μA.....	\$3.20	50V. D.C.....	\$2.60
50-0-50μA	\$3.10	300V. D.C.....	\$2.60
100μA.....	\$2.75	1 amp. D.C.....	\$2.60
100-0-100μA	\$3.10	5 amp. D.C.....	\$2.60
500μA.....	\$2.60	300V. A.C.....	\$2.60
1mA.....	\$2.60	VU Meter.....	\$3.37

"SEW" CLEAR PLASTIC METERS

Type MR.55P. 3 1/4 in. x 4 1/4 in. fronts.

50μA.....	\$3.60	10V. D.C.....	\$2.80
50-0-50μA	\$3.10	20V. D.C.....	\$2.80
100μA.....	\$3.10	50V. D.C.....	\$2.80
100-0-100μA	\$3.00	300V. D.C.....	\$2.80
500μA.....	\$2.90	1 amp. A.C.*	\$2.80
500-0-500μA	\$2.80	5 amp. A.C.*	\$2.80
1mA.....	\$2.80	30 amp. A.C.*	\$2.80
1-0-1mA.....	\$2.80		
50μA.....	\$2.80		
10mA.....	\$2.80		

Type MR.52P. 2 1/4 in. square fronts.

50μA.....	\$2.60	10V. D.C.....	\$2.00
50-0-50μA	\$2.60	20V. D.C.....	\$2.00
100μA.....	\$2.60	50V. D.C.....	\$2.00
100-0-100μA	\$2.50	300V. D.C.....	\$2.00
500μA.....	\$2.30	1 amp. A.C.*	\$2.00
500-0-500μA	\$2.30	5 amp. A.C.*	\$2.00
1mA.....	\$2.00	30 amp. A.C.*	\$2.00
1-0-1mA.....	\$2.00		
50μA.....	\$2.00		
10mA.....	\$2.00		

Type MR.55P. 3 1/4 in. x 3 1/4 in. fronts.

50μA.....	\$3.37	10V. D.C.....	\$2.20
50-0-50μA	\$2.75	20V. D.C.....	\$2.20
100μA.....	\$2.75	50V. D.C.....	\$2.20
100-0-100μA	\$2.65	300V. D.C.....	\$2.20
500μA.....	\$2.65	1 amp. A.C.*	\$2.20
500-0-500μA	\$2.65	5 amp. A.C.*	\$2.20
1mA.....	\$2.20	30 amp. A.C.*	\$2.20
1-0-1mA.....	\$2.20		
50μA.....	\$2.20		
10mA.....	\$2.20		

***MOVING IRON—**
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SEW EDUCATIONAL METERS



Type ED.107. Size 90mm x 108mm.

A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The easily accessible to demonstrate internal working. Available in the following ranges:

50μA.....	\$5.00	20V. d.c.....	\$4.40
100μA.....	\$4.65	50V. d.c.....	\$4.40
1mA.....	\$4.40	300V. d.c.....	\$4.40
50-0-50μA.....	\$4.65		
1-0-1mA.....	\$4.40		
5A d.c.....	\$4.40	Dual range	
5V/50V d.c.....	\$4.65	50mA/5A d.c.....	\$4.65
10V d.c.....	\$4.40		

EDGWISE METERS

Type PE.70. 3 1/2 in. x 1 1/2 in. x 1 1/2 in. deep.

50μA.....	\$3.10	500μA.....	\$2.75
50-0-50μA.....	\$3.10	1mA.....	\$2.45
100μA.....	\$3.00	300V. A.C.....	\$2.45
100-0-100μA.....	\$3.00		
200μA.....	\$2.90	VU Meter.....	\$3.40

Send for illustrated brochure on SEW Panel Meters—discounts for quantities.

MULTIMETERS for EVERY purpose!

ROUND SCALE TYPE PENCIL TESTER MODEL TS.68



Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300V AC and DC at 2,000 ohms. Resistance 0-20K ohms. ONLY \$1.97 P. & P. 15p.

MODEL TE-90 50,000 O.P.V. Mirror scale, overload protection. 0/3/12/60/300/600/1,200 v. D.C. 0/6/30/120/300/1,200 v. A.C. 0/6/60/600mA. D.C. 16K/160K/1.6/16 MEGΩ. -20 to +63 db. \$7.50. P. & P. 15p.

SKYWOOD SW-500 50KΩ/Volt. Mirror scale. DC Volts 0.6/3/12/30/300/600. DC Current 20mA/6/60mA Resistance 10K/100K/1 Meg/10 Meg. Decibels -20 to +67 db. \$7.50. P. & P. 15p.

370 WTR MULTI-METER

Features A.C. current ranges. 20,000 o.p.v. 0/5/2-5/10/50/250/500 1000 V DC. 0/2-5/10/50/250/500/1000 V AC. 0/500A/1/10/100MA/1/10 100MA/1/10 Amp AC 0/5K/50K/500K/5MEG/50MEG. -20 + 62 db. \$15. P. & P. 25p.

FTC-401 TRANSISTOR TESTER

Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. \$6.97. P. & P. 15p.

A76 AUDIO GENERATOR

Portable, mains operated. Sine wave 20 to 200,000 Hz. Square wave 20 to 30,000 Hz. Output voltage Sine 17V P/P. Square 21V P/P. Distortion less than 1%. \$17.50. P. & P. 37p.

TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s-500 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator, audio output. Xial socket for calibration. 220/240V. A.C. Brand new with instructions. \$15. Carr. 37p. Size 140 x 215 x 170 mm.

BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR

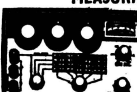


New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240V. A.C. Size 215mm x 150mm x 120mm. Price \$27.50. Carr. 25p.



240° Wide Angle 1mA Meters
MWI-6 60mm square \$29.75
MWI-8 80mm square \$29.75
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TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE



A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω-11.1 megΩ 6 Ranges ±1% L. 1 μH - 111 μH 6 Ranges ±2%. TURNS RATIO 1:1/1000-1:1100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 x 2 in. \$20. P. & P. 25p



UM.049 MULTIMETER 20,000 O.P.V. overload protection. 0/3/30/60/300/600/3000 V DC. 0/6/60/120/600/1200 V AC. 0/60uA/12/300 MA. D.C. 0/60K/6MEG. -20 + 63 db. \$4.50. P. & P. 15p.

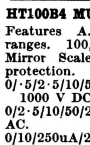


Model S-100TR MULTI-METER TRANSISTOR TESTER 100,000 o.p.v. MIRROR SCALE OVERLOAD PROTECTION 0/12-20-6/3/12/30/120/600 V DC. 0/6/30/120/600 V. AC. 0/12/600uA/12/300MA/12 Amp. DC. 0/10K/1 MEG/100 MEG. -20 to + 50 db. 0-01 - -2 mfd.

Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. \$13.50. P.P. 25p.



TMK MODEL TW-50K 46 ranges, mirror scale, 50K/Volt. D.C. 5K /V Volt A.C. D.C. Volts -125, -25, 1-25, 2-5, 5, 10, 25, 50, 125, 250, 500, 1000V. A.C. Volts: 1-5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50mA, 2-5, 5, 25, 50, 250, 500mA, 5 V. DC. Resistance: 10K, 100K, 1 MEG, 10 MEGΩ. Decibels: -20 to +81.5 dB. \$3.50. P. & P. 17p



HT100B4 MULTI-METER Features A.C. current ranges. 100,000 o.p.v. Mirror Scale, Overload protection. 0/5/2-5/10/50/250/500/1000 V DC. 0/2-5/10/50/250/1000 V AC. 0/10/250uA/2-5/25/250 MA/10 Amp DC. 10 Amp AC. 0/20K/200K/2MEG/20 MEG. -20 + 62 db. \$12.50. P. & P. 25p.

RUSSIAN 22 RANGE MULTIMETER

Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2-5/10/50/250/500/1000V D.C. 2-5/10/50/250/500/1000V A.C. DC Current 100 uA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3MΩ. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUR PRICE \$5.97 P. & P. 25p.

TO-3 PORTABLE OSCILLOSCOPE

3in. tube. Y amp. Sensitivity 0.1 v p-p/CM. Bandwidth 1.5 cps-1.5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0.9v p-p/CM. Bandwidth 1.5 cps-500KHz. Input imp. 2 meg Ω 20pF Time base: 5 divisions 10 cps-300 KHz. Synchronization. Internal/external. Illuminated scale 140 x 215 x 330 mm. Weight 134 lb. 220/240V. A.C. Supplied brand new with handbook. \$37.50. Carr. 50p

HONEYWELL DIGITAL VOLT-METER VT.100

Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt, current and ohms with optional plug in cards. Specification: Accuracy: ± 0.2, ± 1 digit. Resolution: 1mV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1-999). Input impedance: 1000 MegΩ. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100V. D.C. Input: Fully floating (300 volts). Input power: 110-230V. A.C. 50/60 cycles. Overall size: 5 1/2 in. x 2 1/2 in. x 8 3/16 in. AVAILABLE BRAND NEW AND FULLY GUARANTEED AT APPROX. HALF PRICE. \$49.97. Carr. 50p.

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2N3425	2N3426	2N3427	2N3428	2N3429	2N3430	2N3431	2N3432	2N3433	2N3434	CA3000	CA3001	CA3002	CA3003	CA3004	CA3005	CA3006	CA3007	CA3008	CA3009	5A2	5A3	5A4	5A5	5A6	5A7	5A8	5A9	5A10	5A11
2N3435	2N3436	2N3437	2N3438	2N3439	2N3440	2N3441	2N3442	2N3443	2N3444	CA3010	CA3011	CA3012	CA3013	CA3014	CA3015	CA3016	CA3017	CA3018	CA3019	6AR5	6AR6	6AR7	6AR8	6AR9	6AR10	6AR11	6AR12	6AR13	6AR14
2N3445	2N3446	2N3447	2N3448	2N3449	2N3450	2N3451	2N3452	2N3453	2N3454	CA3020	CA3021	CA3022	CA3023	CA3024	CA3025	CA3026	CA3027	CA3028	CA3029	6AV6	6AV7	6AV8	6AV9	6AV10	6AV11	6AV12	6AV13	6AV14	6AV15
2N3455	2N3456	2N3457	2N3458	2N3459	2N3460	2N3461	2N3462	2N3463	2N3464	CA3030	CA3031	CA3032	CA3033	CA3034	CA3035	CA3036	CA3037	CA3038	CA3039	6BA6	6BA7	6BA8	6BA9	6BA10	6BA11	6BA12	6BA13	6BA14	6BA15
2N3465	2N3466	2N3467	2N3468	2N3469	2N3470	2N3471	2N3472	2N3473	2N3474	CA3040	CA3041	CA3042	CA3043	CA3044	CA3045	CA3046	CA3047	CA3048	CA3049	6BE6	6BE7	6BE8	6BE9	6BE10	6BE11	6BE12	6BE13	6BE14	6BE15
2N3475	2N3476	2N3477	2N3478	2N3479	2N3480	2N3481	2N3482	2N3483	2N3484	CA3050	CA3051	CA3052	CA3053	CA3054	CA3055	CA3056	CA3057	CA3058	CA3059	6BG6	6BG7	6BG8	6BG9	6BG10	6BG11	6BG12	6BG13	6BG14	6BG15
2N3485	2N3486	2N3487	2N3488	2N3489	2N3490	2N3491	2N3492	2N3493	2N3494	CA3060	CA3061	CA3062	CA3063	CA3064	CA3065	CA3066	CA3067	CA3068	CA3069	6BR7	6BR8	6BR9	6BR10	6BR11	6BR12	6BR13	6BR14	6BR15	6BR16
2N3495	2N3496	2N3497	2N3498	2N3499	2N3500	2N3501	2N3502	2N3503	2N3504	CA3070	CA3071	CA3072	CA3073	CA3074	CA3075	CA3076	CA3077	CA3078	CA3079	6BW6	6BW7	6BW8	6BW9	6BW10	6BW11	6BW12	6BW13	6BW14	6BW15
2N3505	2N3506	2N3507	2N3508	2N3509	2N3510	2N3511	2N3512	2N3513	2N3514	CA3080	CA3081	CA3082	CA3083	CA3084	CA3085	CA3086	CA3087	CA3088	CA3089	6C4	6C5	6C6	6C7	6C8	6C9	6C10	6C11	6C12	6C13
2N3515	2N3516	2N3517	2N3518	2N3519	2N3520	2N3521	2N3522	2N3523	2N3524	CA3090	CA3091	CA3092	CA3093	CA3094	CA3095	CA3096	CA3097	CA3098	CA3099	6CD6	6CD7	6CD8	6CD9	6CD10	6CD11	6CD12	6CD13	6CD14	6CD15
2N3525	2N3526	2N3527	2N3528	2N3529	2N3530	2N3531	2N3532	2N3533	2N3534	CA3100	CA3101	CA3102	CA3103	CA3104	CA3105	CA3106	CA3107	CA3108	CA3109	6CG6	6CG7	6CG8	6CG9	6CG10	6CG11	6CG12	6CG13	6CG14	6CG15
2N3535	2N3536	2N3537	2N3538	2N3539	2N3540	2N3541	2N3542	2N3543	2N3544	CA3110	CA3111	CA3112	CA3113	CA3114	CA3115	CA3116	CA3117	CA3118	CA3119	6CH7	6CH8	6CH9	6CH10	6CH11	6CH12	6CH13	6CH14	6CH15	6CH16
2N3545	2N3546	2N3547	2N3548	2N3549	2N3550	2N3551	2N3552	2N3553	2N3554	CA3120	CA3121	CA3122	CA3123	CA3124	CA3125	CA3126	CA3127	CA3128	CA3129	6CJ1	6CJ2	6CJ3	6CJ4	6CJ5	6CJ6	6CJ7	6CJ8	6CJ9	6CJ10
2N3555	2N3556	2N3557	2N3558	2N3559	2N3560	2N3561	2N3562	2N3563	2N3564	CA3130	CA3131	CA3132	CA3133	CA3134	CA3135	CA3136	CA3137	CA3138	CA3139	6CK7	6CK8	6CK9	6CK10	6CK11	6CK12	6CK13	6CK14	6CK15	6CK16
2N3565	2N3566	2N3567	2N3568	2N3569	2N3570	2N3571	2N3572	2N3573	2N3574	CA3140	CA3141	CA3142	CA3143	CA3144	CA3145	CA3146	CA3147	CA3148	CA3149	6CL6	6CL7	6CL8	6CL9	6CL10	6CL11	6CL12	6CL13	6CL14	6CL15
2N3575	2N3576	2N3577	2N3578	2N3579	2N3580	2N3581	2N3582	2N3583	2N3584	CA3150	CA3151	CA3152	CA3153	CA3154	CA3155	CA3156	CA3157	CA3158	CA3159	6CM6	6CM7	6CM8	6CM9	6CM10	6CM11	6CM12	6CM13	6CM14	6CM15
2N3585	2N3586	2N3587	2N3588	2N3589	2N3590	2N3591	2N3592	2N3593	2N3594	CA3160	CA3161	CA3162	CA3163	CA3164	CA3165	CA3166	CA3167	CA3168	CA3169	6CN6	6CN7	6CN8	6CN9	6CN10	6CN11	6CN12	6CN13	6CN14	6CN15
2N3595	2N3596	2N3597	2N3598	2N3599	2N3600	2N3601	2N3602	2N3603	2N3604	CA3170	CA3171	CA3172	CA3173	CA3174	CA3175	CA3176	CA3177	CA3178	CA3179	6CP6	6CP7	6CP8	6CP9	6CP10	6CP11	6CP12	6CP13	6CP14	6CP15
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2N3615	2N3616	2N3617	2N3618	2N3619	2N3620	2N3621	2N3622	2N3623	2N3624	CA3190	CA3191	CA3192	CA3193	CA3194	CA3195	CA3196	CA3197	CA3198	CA3199	6CR6	6CR7	6CR8	6CR9	6CR10	6CR11	6CR12	6CR13	6CR14	6CR15
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2N3635	2N3636	2N3637	2N3638	2N3639	2N3640	2N3641	2N3642	2N3643	2N3644	CA3210	CA3211	CA3212	CA3213	CA3214	CA3215	CA3216	CA3217	CA3218	CA3219	6CT6	6CT7	6CT8	6CT9	6CT10	6CT11	6CT12	6CT13	6CT14	6CT15
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2N3665	2N3666	2N3667	2N3668	2N3669	2N3670	2N3671	2N3672	2N3673	2N3674	CA3240	CA3241	CA3242	CA3243	CA3244	CA3245	CA3246	CA3247	CA3248	CA3249	6DA6	6DA7	6DA8	6DA9	6DA10	6DA11	6DA12	6DA13	6DA14	6DA15
2N3675	2N3676	2N3677	2N3678	2N3679	2N3680	2N3681	2N3682	2N3683	2N3684	CA3250	CA3251	CA3252	CA3253	CA3254	CA3255	CA3256	CA3257	CA3258	CA3259	6DB6	6DB7	6DB8	6DB9	6DB10	6DB11	6DB12	6DB13	6DB14	6DB15
2N3685	2N3686	2N3687	2N3688	2N3689	2N3690	2N3691	2N3692	2N3693	2N3694	CA3260	CA3261	CA3262	CA3263	CA3264	CA3265	CA3266	CA3267	CA3268	CA3269	6DC6	6DC7	6DC8	6DC9	6DC10	6DC11	6DC12	6DC13	6DC14	6DC15
2N3695	2N3696	2N3697	2N3698	2N3699	2N3700	2N3701	2N3702	2N3703	2N3704	CA3270	CA3271	CA3272	CA3273	CA3274	CA3275	CA3276	CA3277	CA3278	CA3279	6DE6	6DE7	6DE8	6DE9	6DE10	6DE11	6DE12	6DE13	6DE14	6DE15
2N3705	2N3706	2N3707	2N3708	2N3709	2N3710	2N3711	2N3712	2N3713	2N3714	CA3280	CA3281	CA3282	CA3283	CA3284	CA3285	CA3286	CA3287	CA3288	CA3289	6DF6	6DF7	6DF8	6DF9	6DF10	6DF11	6DF12	6DF13	6DF14	6DF15
2N3705A	2N3706A	2N3707A	2N3708A	2N3709A	2N3710A	2N3711A	2N3712A	2N3713A	2N3714A	CA3290	CA3291	CA3292	CA3293	CA3294	CA3295	CA3296	CA3297	CA3298	CA3299	6DG6	6DG7	6DG8	6DG9	6DG10	6DG11	6DG12	6DG13	6DG14	6DG15
2N3715	2N3716	2N3717	2N3718	2N3719	2N3720	2N3721	2N3722	2N3723	2N3724	CA3300	CA3301	CA3302	CA3303	CA3304	CA3305	CA3306	CA3307	CA3308	CA3309	6DH6	6DH7	6DH8	6DH9	6DH10	6DH11	6DH12	6DH13	6DH14	6DH15
2N3725	2N3726	2N3727	2N3728	2N3729	2N3730	2N3731	2N3732	2N3733	2N3734	CA3310	CA3311	CA3312	CA3313	CA3314	CA3315	CA3316	CA3317	CA3318	CA3319	6DI6	6DI7	6DI8	6DI9	6DI10	6DI11	6DI12	6DI13	6DI14	6DI15
2N3735	2N3736	2N3737	2N3738	2N3739	2N3740	2N3741	2N3742	2N3743	2N3744	CA3320	CA3321	CA3322	CA3323	CA3324	CA3325	CA3326	CA3327	CA3328	CA3329	6DJ6	6DJ7	6DJ8	6DJ9	6DJ10	6DJ11	6DJ12	6DJ13	6DJ14	6DJ15
2N3745	2N3746	2N3747	2N3748	2N3749	2N3750	2N3751	2N3752	2N3753	2N3754	CA3330	CA3331	CA3332	CA3333	CA3334	CA3335	CA3336	CA3337	CA3338	CA3339	6DK6	6DK7	6DK8	6DK9	6DK10	6DK11	6DK12	6DK13	6DK14	6DK15
2N3755	2N3756	2N3757	2N3758	2N3759	2N3760	2N3761N																							

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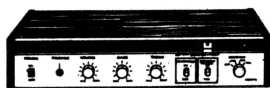
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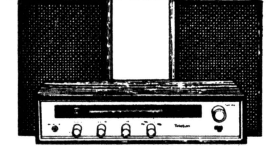
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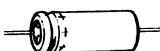
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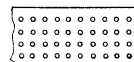
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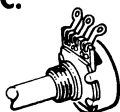
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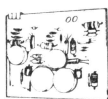
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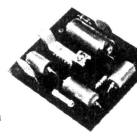
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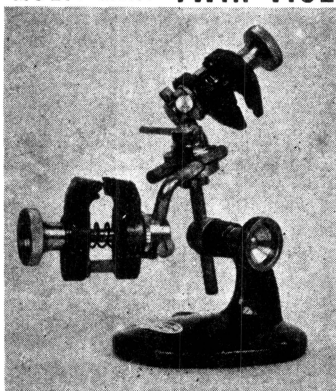
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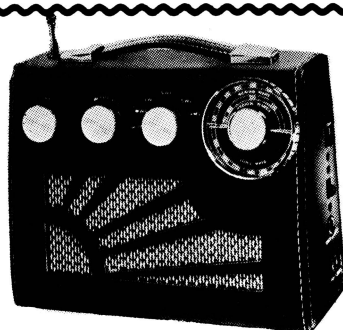
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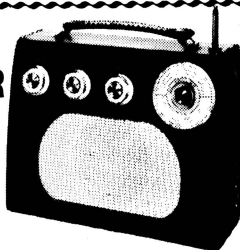
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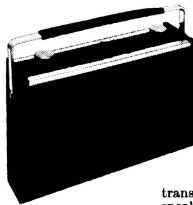
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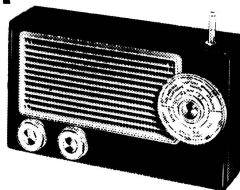
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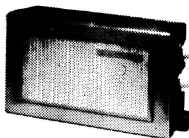


6 Tunable Wavebands: MW, LW, SW1, SW2, Trawler band plus an extra M.W. band for easier tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8

stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 5½ x 2½in. approx. Easy build plans and parts price list 15p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

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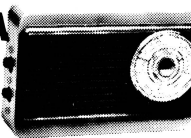


3 Tunable Wavebands: MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc.

7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5½ x 1½ x 3½in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

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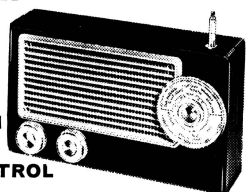
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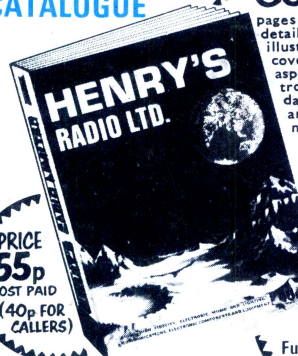
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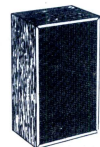


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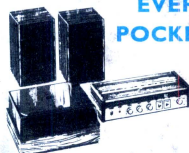
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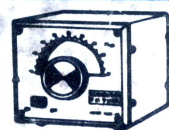
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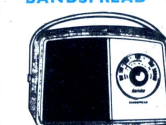


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